July/August 1986
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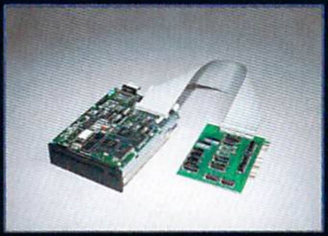
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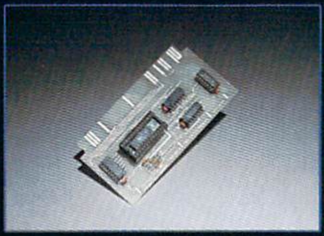
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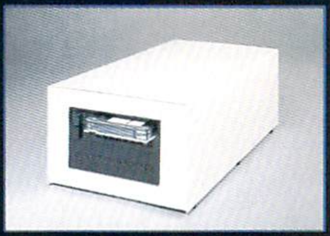
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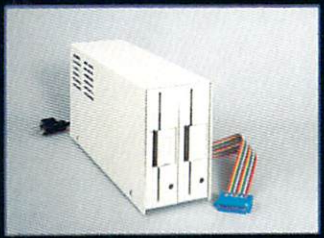
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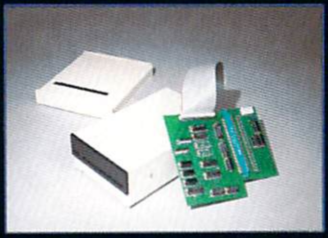
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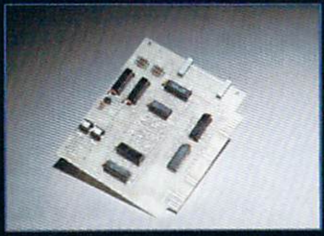
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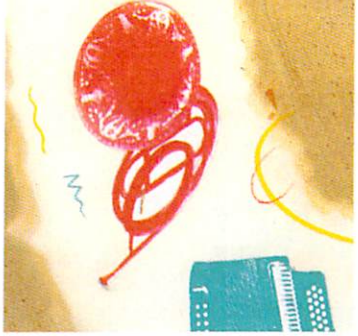
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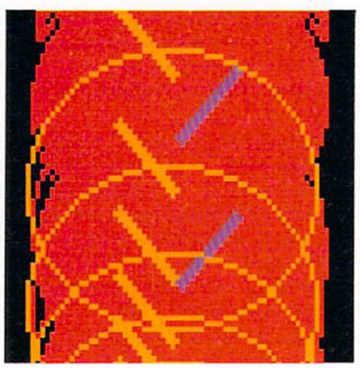
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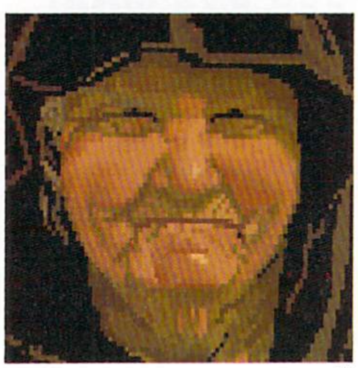
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Avision

By Steve Twombly

Amiga Studio

In this issue of *AmigaWorld*, we will discuss the music and sound capabilities of the Amiga, focusing on the hardware features that let the Amiga sing. This issue will help you make music with your Amiga by using the Sound and Wave commands in Amiga Basic. We'll look at the basics of music synthesis on computers, and more specifically at the principles of digital sound synthesis on the Amiga.

The early pioneers of electronic music, like Vladimir Ussachevsky, Otto Luening and Edgar Varese, would be amazed at the Amiga and the revolutionary advances in their field. I'd be curious to hear an Amiga composition from one of these pioneers.

Composers began experimenting with electronic sounds as early as the 1920s and '30s. Many of these experiments involved radios and non-instrumental sound generators. Before the first synthesizers were built, composers often used a montage of live sounds, which were recorded and then subjected to tape manipulation. This early electronic music composition became known as Music Concrete.

I was first exposed to the Buchla analog synthesizer in 1976 at about the same time that the first Apple microcomputer was introduced. Although it was a major phenomenon at the time, by today's standards, this analog synthesizer was a cumbersome affair. Every sound was created by individually "patching" wires from one voltage control device to another. A finished sound consisted of a multitude of colored wires, their pathways and locations all carefully noted on paper. Sine, sawtooth and square waves were combined with pink or white noise and modulated by frequency, amplitude or ring modulators. The band pass and sharp cut-off filters were patched in, ADSR information was patched in, and so on. Touch control and random-voltage sources were used, and eventually, enough patches and instructions were patched together to create sounds and sequences.

Do you remember the early tape studio? Using half-track stereo and quarter-track machines, composers recorded all sorts of unusual sounds on tape. Then they physically cut up all of the tapes into carefully labeled little pieces and spliced them back together, sometimes backwards and always in different order. After all of this was looped together and played back, some pretty wild sounds were born.

It's amazing to think how much progress in electronic music has been made in just ten years. With the advent of digital synthesis, electronic instrument development has exploded. The Moogs and Arps have been replaced by Rolands, Casios, Korgs, Yamahas, Oberheims and a myriad of other programmable polyphonic synthesizers.

The rapid changes in computer music are equally astounding. Think back to the first computer composition performed by the behemoth mainframe, ENIAC, in the 1950s. As you read through this issue of *AmigaWorld*, you'll realize the dramatic advances that the Amiga represents. Of course, through the MIDI standard, personal computers and synthesizers are merging and interrelating today in a very exciting and dynamic process. All of the old wire patching is now gone, new sounds are quickly programmable, and the tape splicing is easily handled by digital sampling and data manipulation on computer.

The Amiga will have the same sweeping effect in the music field as it will in graphics, video, general and other computing disciplines. For example, the Amiga's built-in digital sampling features are a microcomputing milestone. The Amiga's speech synthesis is also a first for micros, and it will provide unique opportunities in the fields of education, music, programming and others.

The Amiga is beginning to make an impact on the professional music world. Hardware reviews have appeared in at least two electronic music magazines, and several well-known musicians are also excited about the Amiga. In this issue, *AmigaWorld* will speak with two of these, Michael Boddicker and Tom Scott, who performed at the Amiga launch and know the Amiga well.

Several music software packages have been released or announced, and we will take a look at some of these. They include Musicraft from Commodore-Amiga, The Music Studio from Activision and Deluxe Music Construction Set from Electronic Arts. To round out this exciting issue on Amiga sound, *AmigaWorld* will also talk to the developers of the Amiga sound software, Sam Dicker and Bob Hoover. Whether you're a novice or professional, or just curious about the state of music and sound on the Amiga, get ready for some exciting reading. And if you're not interested in music or sound, don't despair—there are plenty of other Amiga-related topics covered here, and I'm sure you will find something of interest and value to you.■

Zeitgeist

By Guy Wright

It has been a year since *AmigaWorld* began. Our Premiere issue was presented to the public on the same day that the Amiga was launched. Although the Amiga wasn't shipped until October '85, we were on a bimonthly schedule beginning in July. The magazine and the computer have both matured. There is real software and hardware now, there are real people buying the Amiga and real people are subscribing to the magazine.

Starting *AmigaWorld* was as difficult as you might expect. There was no machine. There was very little solid information that we could count on. The people at Commodore were running around frantically trying to get things organized, and it seemed as though there was no one person we could contact who knew everything that was going on. We spent a lot of time tracking down and verifying what little information we could gather. Many times the information was inaccurate, or it changed, or it turned out not to be as important as we had originally thought.

There was a lot of excitement, a lot of traveling back and forth from coast to coast, a lot of meetings and late nights. It was also a lot of fun. We started with a very small staff (which remains rather small, compared to most magazines). It was also very, very difficult. We had a nearly impossible schedule of deadlines to meet if we wanted to have the Premiere issue ready at the launch. It would have been simpler to throw together a twenty-page newsletter in black and white, but we wanted *AmigaWorld* to be as different as the Amiga itself. We wanted flash and shine, and above all, we wanted to produce the best magazine ever. Not just the best computer magazine. We wanted to produce the BEST magazine of any kind. It meant spending more money on things like high-quality paper, more color, larger format and paying more for the articles (these are the main reasons that the magazine costs a little more than others). Getting that first issue out also meant breaking a few publishing rules and records. And when it was finished, that Premiere issue was great.

After drinking some champagne and catching up on some sleep, we started work on the second issue, November/December '85. Three problems popped up right away. First, Commodore delayed shipping the Amiga (it was supposed to be shipped in mid August). Second, since we had stretched all the deadlines so far in order to get the first issue out, we were already behind schedule getting the second issue out. Third, in that Premiere issue, we had printed just about every snippet of hard information that we had. We had assumed that the Amiga would be out there and authors would be buying and using them and then sending us articles. Commodore didn't ship, authors couldn't get Amigas, and the machine was still changing every day. This meant two things: We would have to work just as hard to put together the second issue as we did for the first, and the second issue could not be as fact-filled as we wanted it to be.

By the time we began working on the third issue, January/February '86, things were beginning to come together a bit. Andy Warhol had an Amiga and was willing to do an interview. There were one or two pieces of software available, and people were beginning to contact us about articles they were writing. But about that time, Commodore announced the 1.1 upgrade to Workbench, and Amiga Basic, from Microsoft, was going to replace ABasiC. Suddenly, about half of the few products that had been released wouldn't work any more. Companies began revising their announced shipping dates for products, and rather than having 12–30 pieces of software to review, we only had one or two beta versions. The articles on programming in ABasiC were no longer worth publishing. So, once again, we had to scramble a bit, with the result that *AmigaWorld* January/February hit the stands with less than the number of hard-hitting articles we would have liked.

We knew when we came out early that the first few issues were not going to be filled with detailed information. We were going to have to give you all the details about the Amiga that we were pretty certain of, and fill up the rest of the magazine with interviews, profiles and talk about future possibilities. Of course, even if we had been able to put program listings and hints on using the CLI into the first few issues, only a few hundred people (those with developer status) would have been able to use the information, because only a few hundred Amigas existed!

With the fourth issue, March/April, things definitely began to turn around. We were just about on schedule, the printer was no longer screaming at us all the time, we could get almost eight hours of sleep at night, and some of us even took weekends off every now and then. The articles were coming in from various places. Authors had Amigas. Companies were beginning to ship products. Commodore seemed to have settled down. There was a brief period of concern when Commodore's bank loans had to be renegotiated, but other than that, *AmigaWorld* and the Amiga were both beginning to pick up some momentum.

I think that our fifth issue, May/June, is evidence that *AmigaWorld* is getting stronger and stronger with each issue. It was the first time that we had more material than space. We were right on schedule (even a little ahead). There were products to review, programming hints and tips we could include and only a minimum of gazing into the future.

This issue, our sixth, is the strongest, most fact-filled and useful issue to date. If you want to judge *AmigaWorld* magazine on one issue alone, then let this be the one. It may have taken a year to get to this point, but now that we are here, there is no going backward. It would have been nice to start off with these kinds of articles in the Premiere issue, but they just didn't exist a year ago. The Amiga, in its present form, didn't exist a year ago.

So, now it's summer again. We have survived, grown and improved over the past year, and so has the Amiga. There is a great year ahead of us, and every new issue of *AmigaWorld* will be better than the last. Looking back, it was a tough year. A fascinating, frustrating, rewarding and exciting year. A year that is faithfully recorded in six issues of the best magazine ever produced.■

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Repartee

Off the Ground

I am an enthusiastic Amiga owner as well as a charter subscriber to AmigaWorld. *I just received the May/June '86 issue and I was so favorably impressed with it that I just had to write to you and tell you that you have finally gotten this magazine off the ground and flying. This issue is so much better than any of the previous issues that there is no comparison. I must say that I found the first four issues to be interesting reading, but you have finally hit on what I and all other Amiga owners have been waiting for. We want you to tell us how this fantastic computer works and how* we *can use it.*

Philip W. Shew
Hagerstown, MD

Amiga Speaks for Itself

I read with interest your column [Zeitgeist] in the May/June issue regarding the many critics of the Amiga. In the months since the release of the Amiga, I have read articles predicting doom for Commodore with the reasoning that the initial lack of software will cause the Amiga to be a flop, and therefore Commodore will go out of business. The same situation existed for the Commodore 64 in the beginning. The critics had the same prediction and we now know how wrong they were.

I have also noticed an increasing number of advertisements by competitors (particularly for the Atari 520ST) that have used misleading, and in one case, totally false statements about the Amiga. Why the criticism? Perhaps the Amiga makes them nervous. Fortunately, the Amiga speaks for itself (figuratively and literally).

Paul Loss
Commack, NY

Educate Your Dealer

When I bought an Amiga, I expected minor problems. What I didn't expect was problems with the dealers, and there are quite a few.

A misinformed or lazy dealer can taint the image of a computer. I have seen some computer dealers who have the Amiga turned off while a Macintosh is running a black-and-white graphics demo next to it. One dealer even told me that the Amiga is IBM and *Macintosh compatible. Finally, many dealers I have spoken to are unfamiliar with software and hardware available or under development for the Amiga.*

It is up to you and I to try to inform our dealers of what is going on and of remedies to common problems that we encounter. The result will be informed dealers who will sell more Amigas.

John Slocum
Philadelphia, PA

Dismal Afternoon

I'm impressed with Amiga Basic. At last, we have a full-featured Basic with access to most of the machine's capabilities, and as far as Basic goes, it is fast.

My applications, however, demand even greater speed. Recursive mathematics and solid geometry typically require gobs of calculations. One particular problem, computing the Mandelbrot set, takes from 15 to 24 hours to complete. I thought, "Wait till I get my hands on an assembler!"

I have just spent a rather dismal afternoon trying to do just that. First of all, I discovered that there is no technical information available for the Amiga. Second, the only Amiga assembler I can find will work only with Version 1.0 Kickstart (I have Version 1.1) and two disk drives.

Two *disk drives? Why two? Can it be made to work with one? I don't want to buy another disk drive. The salesman doesn't know the answers, but he sympathizes. I go home, depressed. I find that Amiga Basic has churned out another ten lines of the Mandelbrot set while I have been out.*

I cannot understand salespeople who know nothing about a product beyond its price. I cannot understand a company that does not make crucial information, such as hardware requirements, available to their distributors. My point here is that this machine, bursting with potential, cannot survive without proper support from Commodore-Amiga and their distributors.

Paul M. Carlisle
Royal Oak, MI

Bantam Computer Books publishes *The AmigaDOS Manual* ($24.95). Addison-Wesley now publishes technical manuals for the Amiga, including a Hardware Reference Manual, two ROM Kernel Manuals and an Intuition Reference Manual.

The only assembler currently available for the Amiga is the Amiga Assembler ($99.95), a macro assembler/linker program from Commodore, which requires two disk drives.

—Editors

Where, Oh Where Is the Software?

I've had my Amiga for 90 days. I've joined a user's group. I've bought a couple of games (Mindshadow and Witness), Deluxe Paint, and I've waited.

Waited for the IBM emulator [Transformer], for example. When I bought the machine, I was told that it would be available in December. Still no IBM emulator!

As you know, there is only one word processor now available [Textcraft]. Where is Enable/Write? Where are the others we had expected? Not even scheduled for delivery!

That you were able to publish four issues with so few programs available for review is nothing short of amazing. What's the problem? I don't know, but I'm willing to guess that the software publishers have taken an attitude of "wait until they've got the DOS straightened out" before they're willing to market a finished product.

I have confidence that, eventually, there will be all the software for which we are now looking, but if you have some application for which you need software now, you will be disappointed.

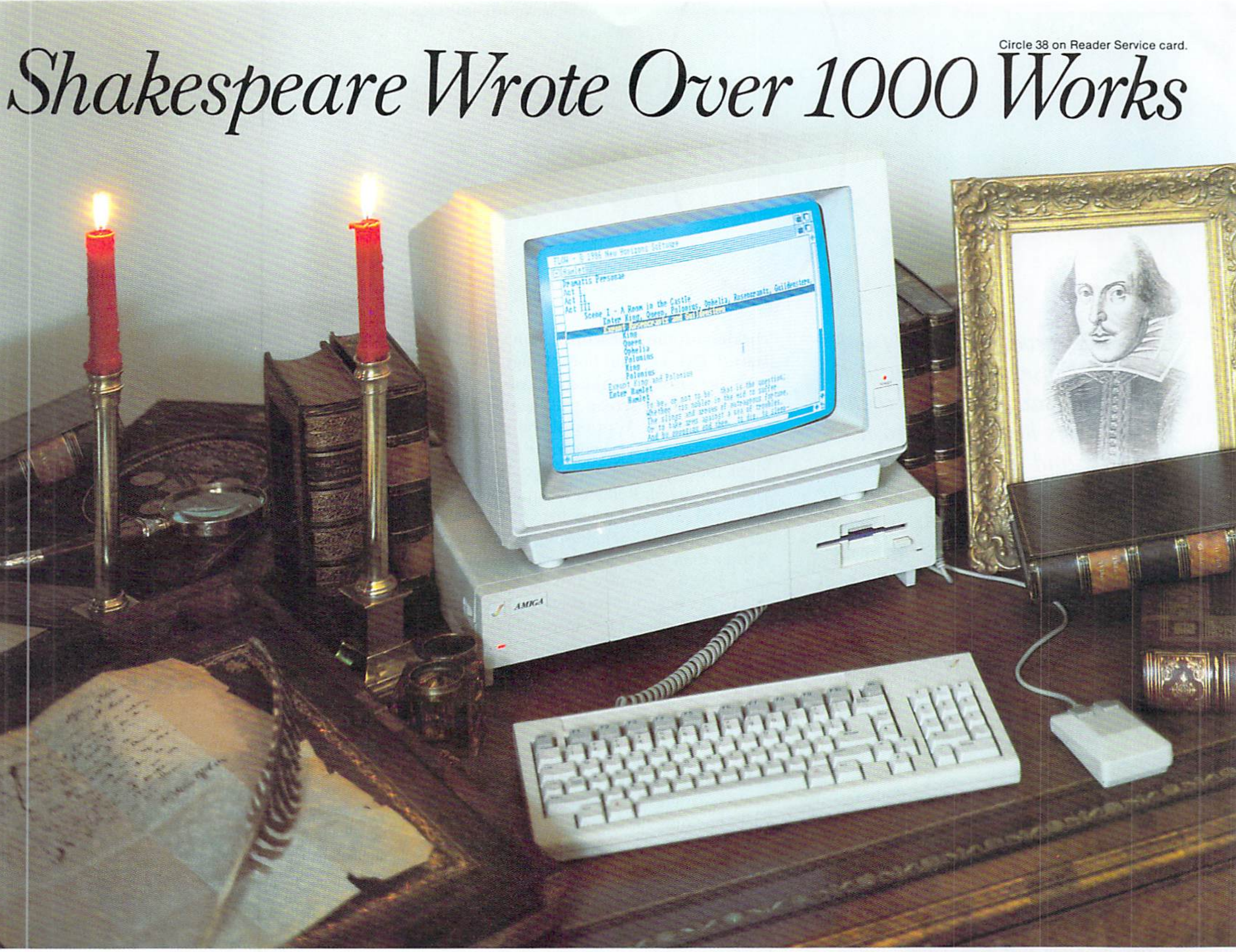
In the meantime, I hope that your magazine is successful. I don't envy your having to go to press with so little to review.

Nelson R. Kerr, Jr.
Reston, VA

There was virtually nothing available for us to review until our March/April issue. This issue is our meatiest so far in terms of reviews and new product announcements. The Amiga software market is slowly beginning to come to life. Slowly. Still no sign of the Transformer, Enable/Write, etc., etc. Patience, my friend, patience.

—Editors

Send your letters to: Repartee, *AmigaWorld* editorial, 80 Pine St., Peterborough, NH 03458. Letters may be edited for space and clarity.



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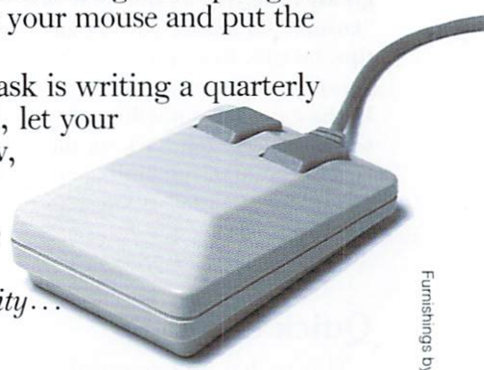
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Hors d'oeuvres

Finally served, delicately seasoned, chosen from around the world of savory Amiga cooking. Our chefs have prepared a bit of this and a touch of that to whet the appetite and take the edge off the insatiable hunger that we know you all have; a craving that can never be totally satisfied, but only partially appeased. Here they are: Hors d'oeuvres. But before we begin the feast, a few bon mots from the maitre d'.

All those wishing to submit their favorite recipes for possible publication in Hors d'oeuvres should include with their tidbit: their name, address and T-shirt size. All submissions become the property of *AmigaWorld* magazine, so don't send us anything that you wouldn't want us to have *forever*. Amazing as it sounds, great minds think alike, and we have to publish these snippets as we get them. Also note: Our chefs try to sample each and every morsel, but sometimes something slips through our greasy little fingers that may not be entirely "kosher," so before you try any of these tips, be sure that you are working with *backups* of your Workbench, or whatever, disk. In the case that something goes wrong, you will be able to fall back on the original. If you find one of our little gems to be "unpalatable," then let us know so that we can warn others.

Beyond that. . .*Bon Appétit!*

Quick CLI

This tip has no one specific author, and most people probably already know it, but for those few who might not know about it yet. . . . There is a very fast way to get to the CLI without first going through Workbench, then clicking on the system drawer, then clicking on the CLI icon. When you warm start (CTRL key and both Amiga keys) or after the "insert Workbench" prompt from a cold start, the screen will be blank for a moment or two. Wait until you get the initial Copyright message on the screen (Copyright 1985 Commodore-Amiga, Inc. All rights reserved. Release 1.1) then hold down the CTRL key and press the D key before the normal Workbench screen appears. Rather than going into Workbench, you will get a BREAK message and the CLI prompt >. To get back to Workbench, type LOADWB. After it has finished loading, click the left mouse button (to reactivate the CLI window) and type ENDCLI. The CTRL–D sequence is the command to interrupt batch file execution. The next few hors d'oeuvres deal with the CLI, startup-sequence and RAM DOS. For more detailed information about some of the tips below, see the article "Window on AmigaDOS" in our May/June 1986 issue.

RAM DOS

Single-drive owners are frequently requested to replace the Workbench disk in DF0: when performing tasks. Even simple things like getting a directory listing in the CLI mode can take a number of disk swaps. An easy solution to the swapping problem is to create a RAM disk directory and copy into it all the commands normally found in the C directory. The procedure is very simple. From the CLI prompt type:

```
MAKEDIR RAM:C
COPY C RAM:C
ASSIGN C: RAM:C
```

After the commands are copied into RAM, your Amiga behaves as if you have two disk drives labled RAM: and DF0:. This should make life a lot easier for single-drive users, but there is a catch: When all the commands are copied, you are only left with about 271K, so this technique is only practical for users with 512K RAM or more.

Sam Spear
Fort Worth, TX

Editor's Note: We received a number of variations on this theme, as you will see below. One of our own ideas was to change the second line to read COPY C RAM:C QUIET so that you don't have to watch all the command names scroll by as they are copied. We have not tested this with too many programs, so there is a possibility that a memory crunch might occur. Let us know if you find other uses and/or problems with RAM DOS.

Startup RAM DOS

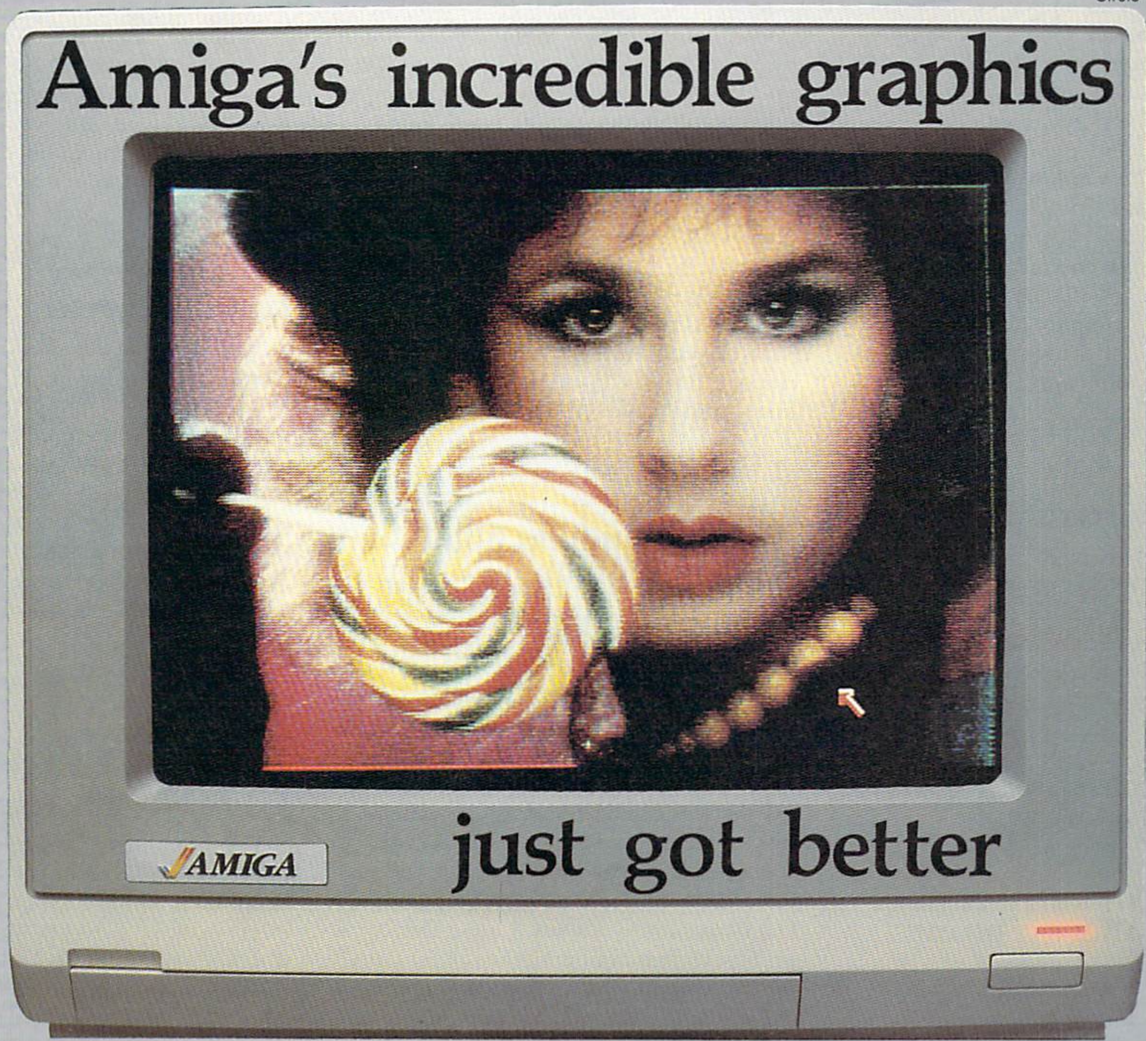
If you use the CLI a great deal and have only one disk drive, you can edit the startup-sequence to automatically create a RAM DOS for you and then leave you in the CLI without calling Workbench.

First, *make a backup copy of your Workbench disk!!!* This will enable you to start over in the event of a mishap. From the CLI prompt, type ED S/STARTUP–SEQUENCE. This will call up the editor program where you may then change the startup sequence. You can use the arrow keys to move around in the text; the CTRL and B keys let you delete lines. The ECHO command simply prints text on the screen so you can customize your startup screen to read anything you want. (For more information about the ED, see "Using the Amiga Editor" in the May/June 1986 issue of *AmigaWorld*.) Change the startup-sequence to include the following lines:

```
MAKEDIR RAM:C
COPY C RAM:C
ASSIGN C: RAM:C
CD RAM:
```

Delete the last two lines of the startup-sequence (LoadWB and endcli >nil) if you do not want to enter Workbench after creating the RAM DOS. When everything looks the way you want it to, press the ESC key, then the X key, and then press Return. This will save your changes to the disk, replacing the original startup-sequence with your new ►

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version. (This is why you only want to try this on a backup copy of Workbench.) If you hopelessly mess things up, press the ESC key then the Q key to exit the ED without saving changes.

Now, when you warm or cold start your Amiga, the RAM DOS will automatically be created for you. For switching back and forth between disk "drives" (DF0: and the new RAM:), use the CD (change directory) command. For example, CD DF0: to get back to DF0: or CD RAM: to make the RAM disk the default directory.

Steve Worcester
Buena Park, CA

Date/Time Startup

I found a way to enter the date and time without having to first go into the Preferences section. I edited the startup-sequence using ED. Change the startup-sequence to include the following lines [using the techniques described above]:

```
ECHO " "
ECHO "DEFAULT DATE:"        ; show last
  startup date
DATE
ECHO " "
ECHO "SET THE DATE AND TIME."
ECHO " DD-MMM-YYY HH:MM"
ECHO " "
FAILAT 21       ; error trap
DATE ?      ; request date
IF FAIL
ECHO " "
ECHO "PLEASE TRY AGAIN."
ECHO "USE SPACE TO SEPARATE DATE
  AND TIME."
ECHO " "
DATE ?      ; second chance
ENDIF
DATE
DATE TO SYS:S/LAST-STARTUP-DATE
  ; write a file
ECHO " "
```

Having the startup script request the date is an idea that has been around for a while, but this little sequence is unique in that it writes. As AmigaDOS boots up, it gets the date of the newest files on the Workbench disk. Writing a file when the clock is set during startup ensures that the next time the date is set, it will be set no earlier than the last time you used the computer. The file is written to the "s" directory. That it is named "Last-Startup-Date", even that it actually contains the date, makes no difference; these are merely coincidences of convenience.

One benefit of this startup is that you never have to type out the complete date unless you shamelessly ignore your Amiga for more than a week. The Date function recognizes day names as well as dates, and assumes that if you enter "Monday", you mean the next Monday. Thus, if you last booted on Friday, January 31, 1986, and you respond "23:12 Monday" to the date prompt, it is just as good as typing "23:12:00 03-mar-86", and somewhat easier. If you reboot during the day, just type the current time. As an aside, Date also recognizes "today", "yesterday", and "tomorrow".

Marcus Brooks
Austin, TX

Notepad Address Book

As you know, the Workbench 1.1 disk has a Notepad program in the Utilities drawer. The Notepad consists of 10 pages, each with 49 rows of text. If each page is titled with 3 consecutive letters of the alphabet, the remaining 48 rows can be used as an address book and/or phone directory. I've found it easiest to keep the screen default width and use the sizing gadget to drag the window to full length before saving. There is even room for an opening title page. If you put V, W, X, Y and Z at the top of the last page, you have enough room for a page of notes or important dates on the last page. Using the Style menu allows for endless creativity, and the address/phone listings can easily be printed.

Paul Elliot
Suffield, CT

Pattern Matching

AmigaDOS does not have an explicit wildcard string like the asterisk (*) in MS-DOS. However, a wildcard string can be implemented by using the pattern-matching pair #?. In AmigaDOS the ? is the wildcard symbol for a single character, while the # means match the following pattern multiple times. For example, the command:

```
COPY DF0:SAM/TEST.#? TO DF1:SAM[
```

would copy all the files that begin with TEST. in the SAM directory on the disk in drive 0 to the SAM directory on the disk in drive 1. However, there is a subtle difference between #? and *. Under MS-DOS, the period is a delimiter between the file name and the suffix, but it is not used the same way under AmigaDOS. So, in the previous example, all files named TEST with a suffix would be copied, but the file TEST *itself* would not be copied, since it was not followed by a period.

Sam Spear
Fort Worth, TX

CLI Typewriter

If you want to use the Amiga and your printer as a typewriter, all you have to do is enter COPY * TO PRT: from the CLI prompt. From then on, everything you type on the keyboard will be printed on the printer. To cancel the command, press CTRL and \ at the same time. We've used this technique to make labels for slide trays, 8mm movies, video cassettes and even a list of Amiga commands for quick reference.

Ms. V. Bende
Whitby, Ontario
Canada

Two-Drive Diskcopy From Workbench

This one was so simple that it is embarrasing. Since I hate to constantly exchange disks, I was looking for a way to make use of my external drive. While the documentation talks about the Diskcopy command in the CLI, there was nothing about how to copy disks from Workbench using two drives. All you have to do is put a blank disk in one drive and the disk you wish to copy in the other, then drag the source disk icon on top of the empty ("Bad") disk icon. In one minute and 35 seconds, you will have a perfect copy of the source disk.

Thomas H. Cosgrove
Frederick, MD

Snapshot

Although there is documentation in the Amiga manuals on how to use the Snapshot function, some clarification is in order. Open, size and position the window and arrange the icons inside where you want them, then position the disk icon where you want it also. When this is done, while holding down the shift key, single click all the icons (even the main disk icon). When they are *all* selected (they will turn dark), then select SNAPSHOT from the Special menu. After your changes have been recorded on the disk, you may close the window and reopen it just to be sure everything is now as you want it to appear.

Steve Butcher
Long Beach, CA


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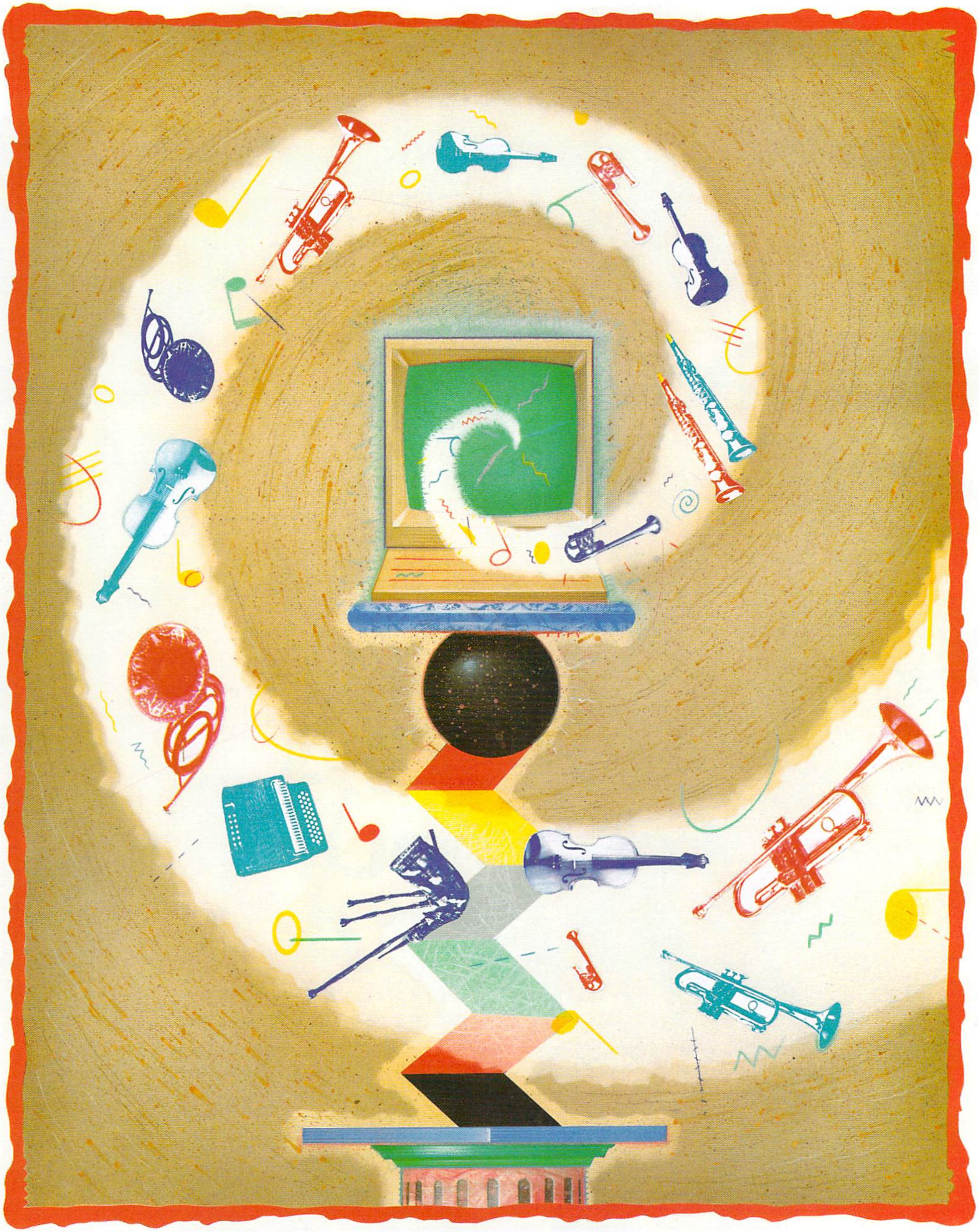


Illustration by Stephen Lyons

Music Synthesis and the Amiga

In this introduction to music synthesis and the Amiga, you will learn how the Amiga creates musical sounds and how to use them with Amiga Basic.

By Peggy Herrington

The two most popular ways of synthesizing sound are descriptively categorized as *additive* and *subtractive*. Subtractive synthesis is modeled on the way sound is produced in many real-life situations. When you speak or sing, the sound heard is an instance of your throat, tongue, mouth, lips, etc., filtering and controlling properties of the sound produced by your vocal chords. The overwhelming majority of today's synthesizers produce sound in a similar way—by filtering out (*subtracting*) unwanted properties of sound waves they generate electronically. You can spot subtractive synthesizers by the descriptions of the waveforms they generate (usually sawtooth, square, triangle and noise) and the filters and ADSR (attack/decay/sustain/release) envelopes they use to modify those sounds.

Additive Synthesis

The Amiga uses a method of synthesis that works the other way around. Rather than removing portions of sounds produced by hardware, the Amiga builds sound from the bottom up through additive synthesis using digital instructions (numbers) from its memory. It produces the sound itself with four tiny digital-to-analog convertors that can turn numbers into complex sounds. Although additive synthesis isn't used as widely as subtractive, lots of information about it is available as it has been used in universities for "serious" musical study for years. The technique was around, in fact, long before subtractive synthesis. Additive has the inherent advantage of being much more flexible than subtractive synthesis because it is based on software instructions rather than hardware devices. This advantage is further enhanced in the Amiga because the sound system and memory coexist with a very powerful computer.

Sine Waves

Sound is something we experience when movement in the air strikes our ear drums. We call it a *wave* of sound because an air disturbance moves away from its source in much the same way as waves or ripples on the surface of a pond move outward from a drop of rain. Sound in general can be acoustically reduced to the sum of several pure tones of differing frequencies. These pure tones are called *sine waves*, and although no acoustic instrument sounds them, sine waves can be generated quite handily by the Amiga. Grouped into one sound, they are known collectively as a *fundamental with harmonic overtones*. Overtones are what make sounds unique—their presence or absence is what makes my voice different (too bad for me) from Lena Horn's, and tell you the difference between a piano and a guitar, for instance, even when they're both sounding middle C. Because of overtones, a particular musical sound or voice is said to possess its own unique *timbre*.

A sine wave is convenient to work with, but not particularly exciting to listen to. If you don't want to take my word for it, try running these two lines in Amiga Basic. They will sound middle C for one second using a sine wave.

```
WAVE 0,SIN
SOUND 261.63,18.2,100,0
```

Sawtooth waves

By using the computing power of the Amiga with Amiga Basic, we can add some harmonic sine waves (overtones) to another sine wave and construct a more aurally rewarding timbre. The Wavebuilder program (p. 22) contains an Amiga Basic program that allows us to do this. Once you have typed the program in, hold down the right Amiga key and press R to run the program, or select Start by highlighting it with the mouse pointer on the pull-down menu. ►

Magazine

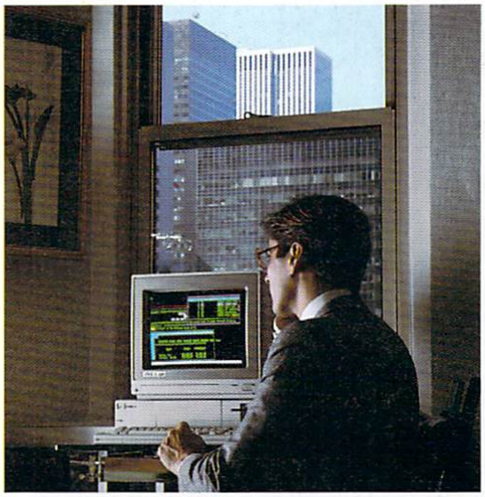
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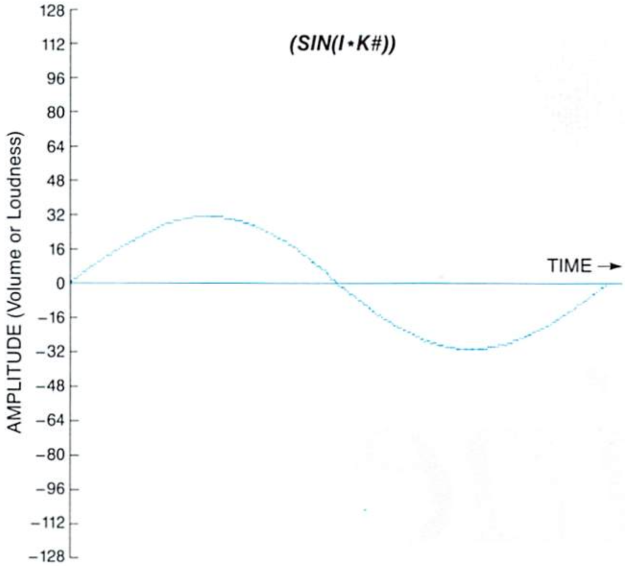


Figure 1.

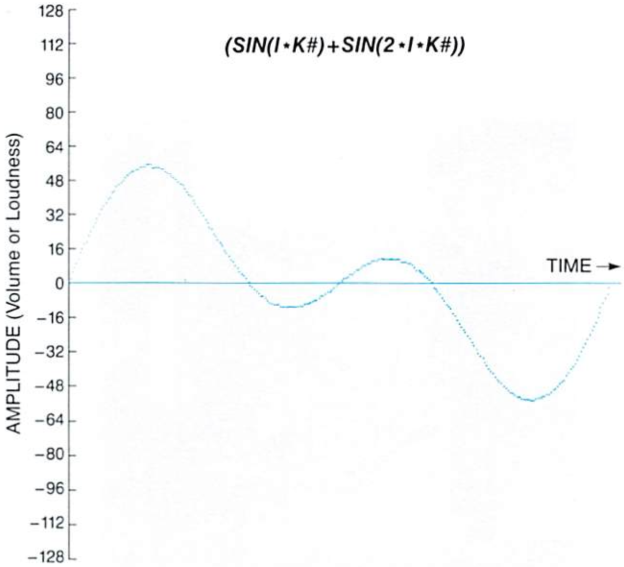


Figure 2.

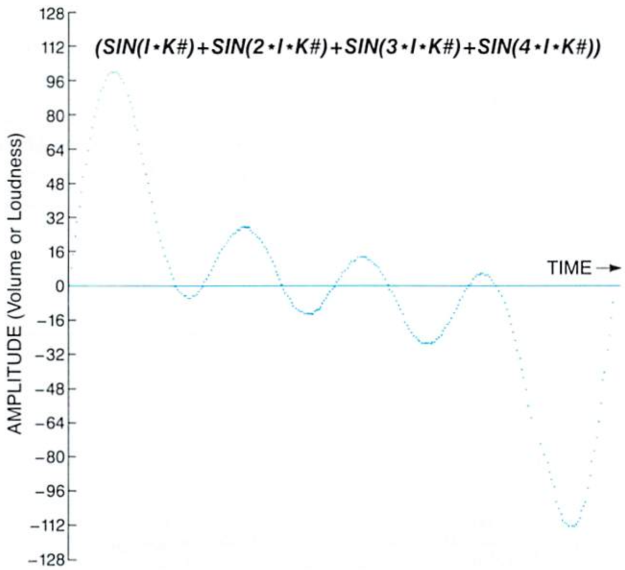


Figure 3.

The routine called *BuildWaveform* prints a series of 256 numbers to a window. (They can be directed to a printer simply by changing PRINT to LPRINT.) These numbers define a sound wave—a fundamental with harmonic overtones—and are stored in memory in an array called TIMBRE, which sound generator 0 uses in the *PlayIt* routine to sound the nine tones known musically as C1 to C9. The fourth tone is middle C.

A graphic analysis of the numbers printed in the window (Figure 4) shows the shape of the wave that this program constructs and uses as a timbre when sounding the tones. The height of that wave (or vertical axis) establishes its *amplitude* or *volume*, and the length (the horizontal axis) shows its distribution over time (which we will get to in a moment when we examine frequency or pitch). Comparing its overall shape with Figure 5d reveals it as one cycle of a sawtooth wave. This particular sawtooth wave produces a rich tone that sounds much like an organ; it is used in the music demo program on the Amiga Extras disk. Examining that program will reveal that the DATA statements used in the *InitSound* routine are precisely the same as the numbers printed in the window by the above program.

This sawtooth wave was constructed by adding a fundamental sine wave and the second, third and fourth harmonic overtones in the long line in the For. . .Next loop in the *BuildWaveform* routine that starts TIMBRE(I).

Figure 1 shows the fundamental sine wave that was used, which you can reproduce numerically (and hear) by deleting the last three expressions in that line to make it read:

```
TIMBRE(I) = 31*(SIN(I*K#))
```

Figure 2 shows a graph of the fundamental with its second overtone, which you can get by using the first two SIN expressions in that line: TIMBRE (I) = 31*(SIN(I*K#) + (SIN(2*I*K#)). Be sure to place them inside the parentheses that enclose all the SIN statements—you'll get a syntax error if you don't. You can continue adding harmonic overtones to a fundamental in this manner to the limit of what a line in Basic will hold; however, experiments with musical instruments have shown that overtones over about the seventh are rather unimportant. You must keep the resultant data within the range of – 128 to 127. Do this by adjusting the multiplier just after the equal sign (31 in the original line). Use the largest multiplier you can without going out of range for the best sound result.

Designing Sound Waves

This program can be easily modified to construct and play other types of sound waves, and even if you don't use them in Amiga music programs, you'll get a better understanding of sound in general and how additive synthesis works by doing so. The fundamental (SIN(I*K#)) should remain; remember, harmonic *overtones* are what define a sound's timbre, so they are what you want to alter. As we've seen, adding overtones in sequence (second, third, fourth, etc.) will produce a sawtooth wave. Adding only odd-numbered overtones (third, fifth, seventh, etc.) will produce a square wave (Figure 5b), which sounds rather hollow, like a clarinet, for instance. Adding only even-numbered overtones



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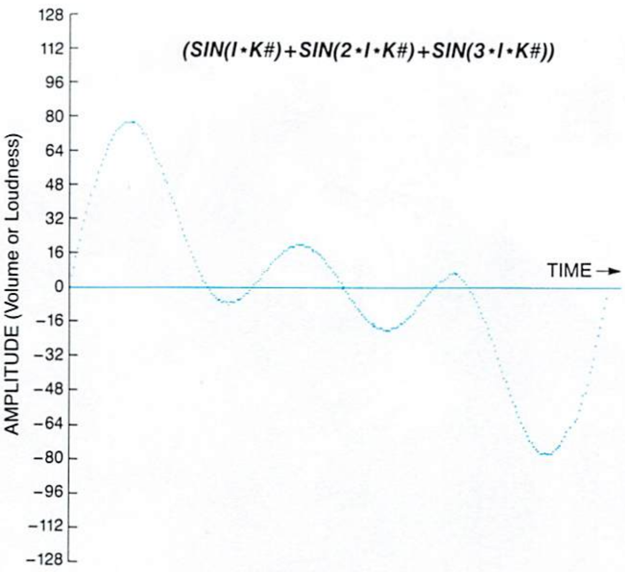


Figure 4.

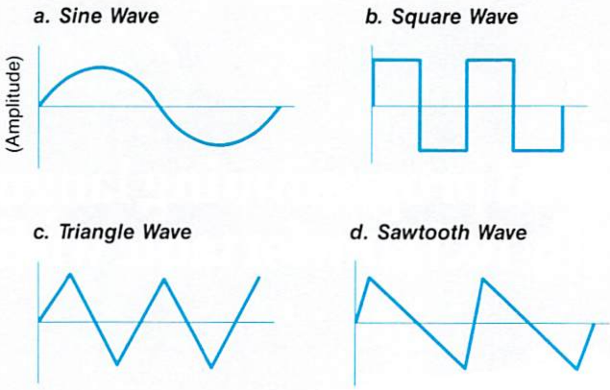


Figure 5.

◄ (two, four, six, etc.) will produce a triangle wave (Figure 5c), which sounds soft and mellow. These waves are interesting musically; they are produced in various forms in conjunction with other aural parameters by acoustic instruments. However, interesting waves can be constructed with overtones that don't seem to follow any pattern. Experiment! The worst that can happen is that you might freeze up your Amiga. If you do, turn it off for a few seconds to reset it to its original state.

Pitch or Frequency

A wave's overall shape determines the timbre of a sound, but has nothing to do with *pitch*, or how high or low it sounds. Pitch is controlled by the number of cycles (or repetition of wave patterns) that pass a point in a given time. This is referred to as a sound wave's *frequency* and is measured in cycles per second. When 261.63 wave patterns pass a given point (such as an ear drum) each second, it produces the frequency musicians call middle C. (For some unexplained reason, engineers and musicians have an aversion to the term cycles per second, and insist on using *Hertz*, after the German physicist Heinrich Hertz.) Sounds from 20 to 15,000 Hertz, which roughly parallels the average person's range of hearing, can be programmed in Amiga Basic and are shown in Figure 6. This chart shows frequencies of notes or musical tones in that range and compares it to MIDI and the standard piano keyboard range. Reading vertically on the chart shows where middle C (C4) is physically located on a piano, its frequency in Hertz, and where the note representing it is placed on the grand staff in standard music notation. This information is supplied for the entire Amiga range. You can use it to translate written music to the frequencies that the Amiga uses, and vice versa.

Durations

The length of time, or the *duration*, the Amiga will play a note is entered as the second number in the SOUND statement. This ranges from 0 to 77, which is a little over four seconds at the most. Collectively, the relationships between durations of the tones that make up a piece of music establishes its overall *tempo*—the difference between waltzing and break dancing, for instance. The Amiga Basic manual suggests values in beats per minute for very slow, *Larghissimo*, to very fast, *Prestissimo* (Italian terms sometimes shown on sheet music). The numerical values shown in the manual seem altogether too fast to me, but again, let experimentation be your guide. Learn to trust your ear.

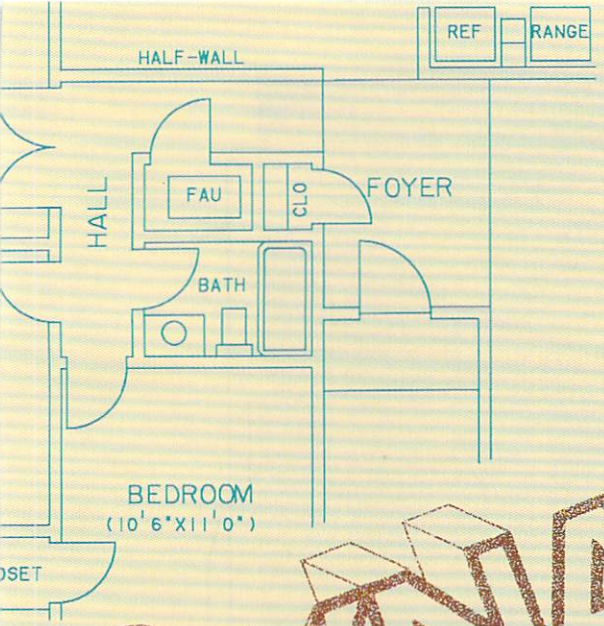
A series of Basic SOUND statements specifying the parameters for each note can be used to play a multiple-part music composition on the Amiga, but writing a program in that form is tedious. For a convenient note-playing subroutine, see Louis Wallace's article "Making Music with Amiga Basic" in this issue, p. 42. By experimenting with the program given here to find timbres you like, you can modify both timbres and notes in Wallace's subroutine and play an altogether different song.

Digital Sampling

Another method of supplying timbre data to the Amiga is with digitally recorded samples. These are brief numeric recordings of real-world sounds that can be manipulated a number of ways under software control to make them even more aurally interesting. Several companies are making sampling devices with which you can make your own samples for use in Basic programs with the correct data format (see "Amiga Music Products," this issue, p. 76). Since data structure for samples is fairly well standardized, you should also be able to download samples intended for other eight-bit devices (for example, the Macintosh) from commercial networks or electronic bulletin boards, and use them in the Amiga.

Conclusion

Many fascinating mathematical relationships exist in music, and the Amiga is perfectly suited for exploring them. We just touched the surface with sine, which you don't have to understand to use, but none of this could have been done without the aid of a computer. No musician, however dedicated, would consider doing all those calculations and adding them by hand 1,280 times as this program does in a few seconds, each time it constructs a waveform. While other personal com- ►

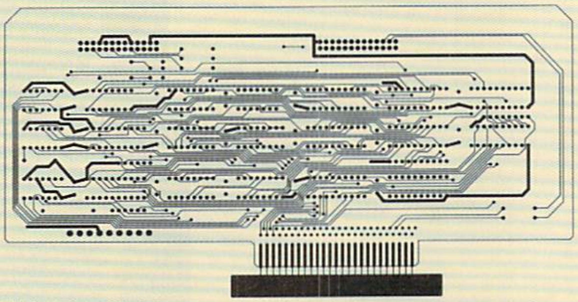


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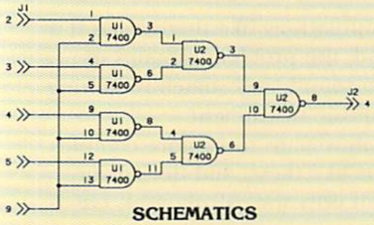
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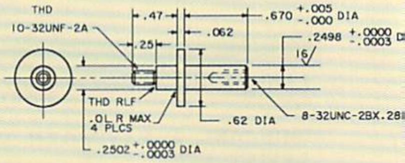
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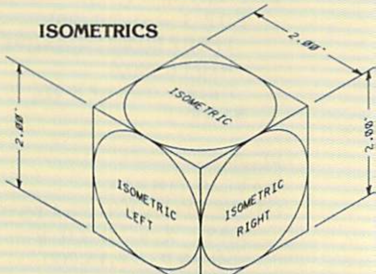


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SIGNAL NAME	COMP NAME	PIN NUMB	SOURCE	TYPE COMP
S0001	J1	2	*	CON
S0001	U1	1		7400
S0002	J1	3	*	CON
S0002	U1	4		7400
S0003	J1	4	*	CON
S0003	U1	9		7400
S0004	J1	5	*	CON
S0004	U1	12		7400
S0005	J1	9	*	CON
S0005	U1	2		7400
S0005	U1	5		7400
S0005	U1	10		7400
S0005	U1	13		7400
S0006	U1	3	*	7400
S0006	U2	1		7400
S0007	U1	6	*	7400
S0007	U2	2		7400
S0008	U1	8	*	7400
S0008	U2	4		7400
S0009	U1	11	*	7400
S0009	U2	5		7400
S0010	U2	3	*	7400
S0010	U2	9		7400
S0011	U2	6	*	7400
S0011	U2	10		7400
S0012	U2	8	*	7400
S0012	J2	4		CON

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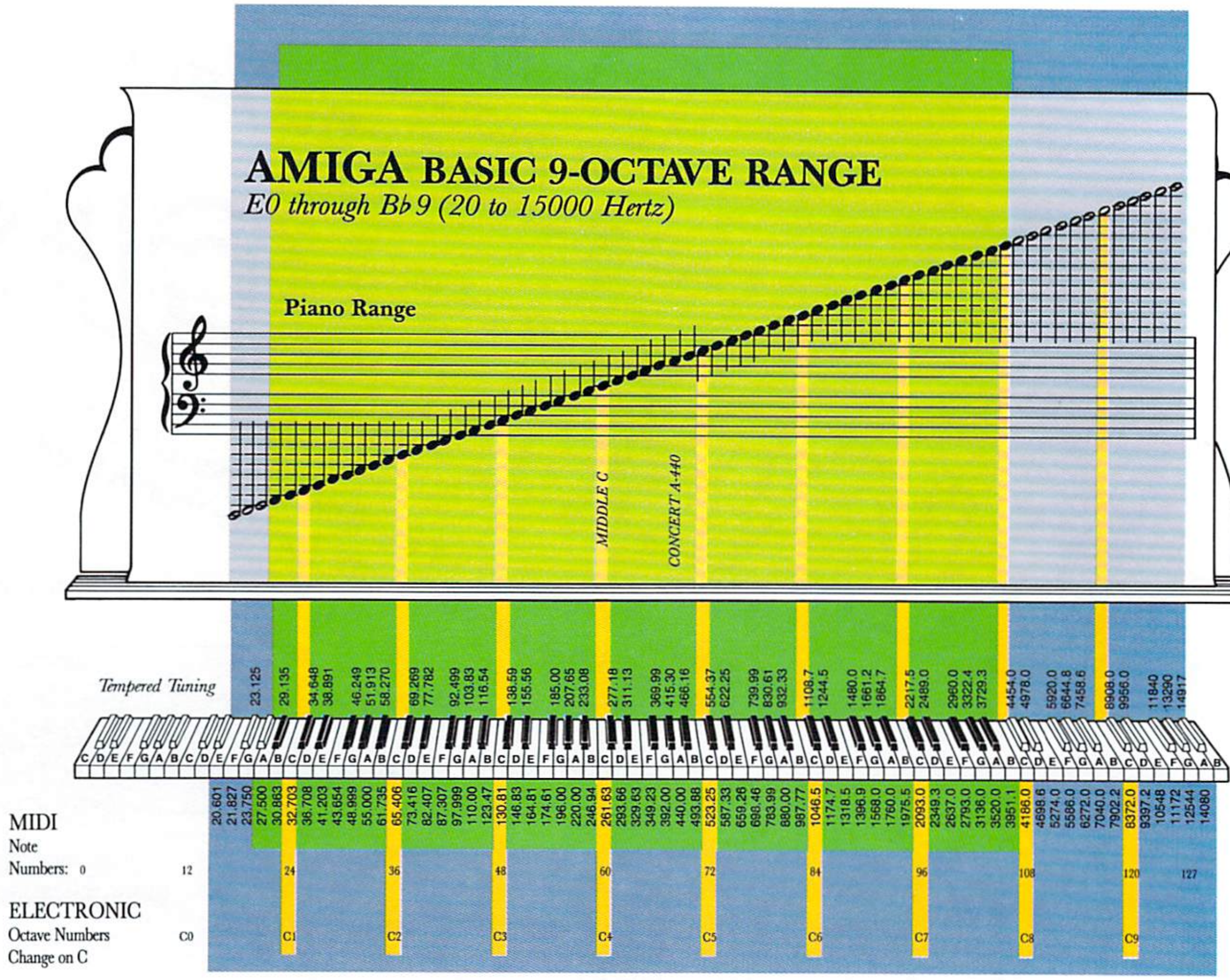


Figure 6.

***Listing 1.** Wavebuilder program.*

```
'BUILDING A WAVEFORM WITH SINE WAVES
DEFINT A-Z
WINDOW 2,"Waveform DATA",,0

BuildWaveform:
K#=2*3.14159265#/256
DIM TIMBRE (255)
   FOR I = 0 TO 255
    TIMBRE(I)=31*(SIN(I*K#)+SIN(2*I*K#)+SIN(3*I*K#)+SIN(4*I*K#))
    WIDTH 80,6
    PRINT TIMBRE (I),
   NEXT I

PlayIt:
WAVE 0,TIMBRE
C#=32.703#:REM PLAYS C1 THROUGH C9
   FOR  X =  0 TO 8
    SOUND C#,15,200
    C#=C#*2
   NEXT X
PRINT
PRINT "Shall I play it again?  (Enter y or n)";

GetAKey:
A$=INKEY$
IF A$="n" THEN PRINT A$:ERASE TIMBRE:PRINT "Program end":END
IF A$="y" THEN PRINT A$:GOTO PlayIt
IF A$<>"y" OR A$<>"n" THEN GetAKey
IF response = 0 THEN GetAKey
```

puters are capable of computations like these, even if a musician has them in hand, the problem remains of converting the results into sound, and somehow getting them into the electronic music instrument.

The Amiga will permit musicians to explore complex mathematical relationships like these, and devise others, and it will perform not only the calculations, but the music as well. Several books are listed below for further study on this subject. Although none are Amiga specific, they describe additive synthesis and other procedures in detail, all of which can be implemented in Amiga Basic programs.■

Bateman, Wayne A., *Introduction to Computer Music*, John Wiley and Sons, 1980.

Chamberlain, Hal, *Musical Applications of Microprocessors*, second edition, Hayden, 1980.

Mathews, Max V., *The Technology of Computer Music*, second edition, MIT Press, 1969.

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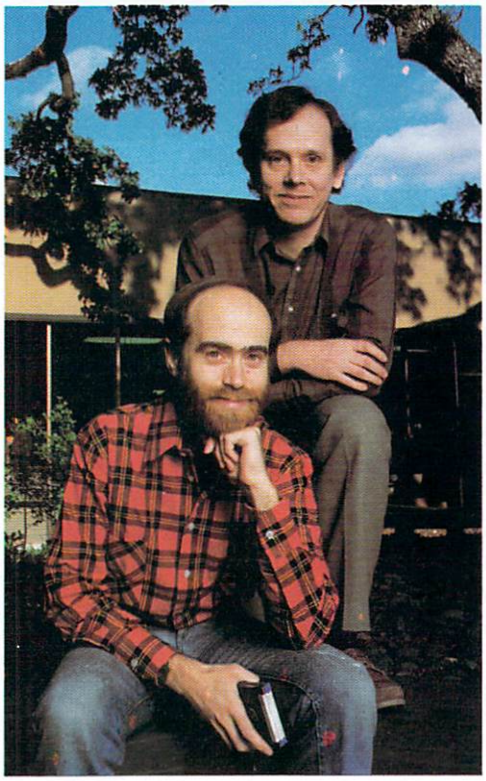
Relevant Terms

►*Acoustic:* of or relating to sound, the sense of hearing, or the science of sound; acoustic instruments are those that do not use electronic modification.
►*Additive synthesis:* the method (used by the Amiga) whereby sounds are digitally constructed from combinations of their basic elements.
►*Amplitude:* volume determined by the height (vertical axis) of a wave at any particular point in a waveform.
►*Cycle:* one complete performance of a vibration or electric oscillation.
►*Digital recording:* a recording made wherein the sound is represented or stored in electronic memory in numerical form (binary).
►*Digital-to-analog converter:* an electronic device that transforms information from the binary numbers computers understand to analog information (information represented in a continuous fashion, such as sound waves or alternating current) that people understand.
►*Duration:* the length of time a particular sound occurs.
►*Frequency:* measured in cycles-per-second, frequency is determined by the number of times individual wave patterns pass a given point each second (e.g., an ear drum).
►*Fundamental with harmonic overtones:* a sound composed of a group of pure tones (sine waves); a fundamental is the principal musical tone upon which overtones—a given series of higher tones—are based.
►*Hertz:* a term used in physics for *cycles per second.*
►*Overtones:* harmonic tones that, when present or absent from a fundamental, give sounds their uniqueness.
►*Pitch:* the highness or lowness of a sound determined by its frequency.
►*Sound waves:* vibratory disturbances in fluids or solids, comparable to ripples or waves in water, detectable by the eardrum in the approximate range of 20–20,000 Hertz.
►*Subtractive synthesis:* the form of sound synthesis wherein unwanted properties are filtered out of a given electronically generated sound to arrive at a desired sound.
►*Tempo:* a piece of music's overall timing determined by the relationships between tone durations.
►*Timbre:* a term used to refer to the unique or characteristic quality of a particular sound or musical voice.
►*Tone:* a sound of definite pitch and vibration.
►*Waveforms:* a mathematical representation of a sound wave displaying its particular characteristics (i.e., pitch, amplitude, etc.), usually pictured via a graph of deviation at a fixed point versus time.

Designing Amiga's Sound

By Peggy Herrington

An interview with Sam Dicker and Bob Hoover, designers of the software for the Amiga's high-quality and highly-touted sounds.



Sam Dicker (front) and Bob Hoover.

Sam Dicker, Manager of Entertainment Software for Commodore-Amiga, and Bob Hoover, now Director of Product Development for Mimetics Corporation of Palo Alto, California, designed the software that drives the Amiga's sound hardware. *AmigaWorld* sat down with them recently to explore their insights and to discuss the sound capabilities of the Amiga.

The Amiga sound system includes two-channel stereo from four independent sound generators, each equipped with a variable rate digital-to-analog converter and a volume control for sound sampling, and a separate low-pass filter for each channel. Standard system software allows for simultaneous access to the sound system and real-time text-to-speech conversion.

AmigaWorld: Sam, how did you get involved with Amiga in the first place?

Sam: Before I was at Amiga I was a developer in the coin-operated video game business. When that started to wane, I was hired by Bob Pariseau to be Amiga's representative from the video game world. We changed our primary direction from a game machine to a personal creativity tool and hired people with experience in operating systems and graphics and other areas, but there was a gap in our software department in sound. I had a fairly good understanding of how to make sounds in general, but I knew very little about the needs of the electronic music community, and that's where Bob came in.

Bob: I had been working as a consultant when, about two years ago, Bob Pariseau and Jay Miner were visiting the music companies, looking for people to work with on the Amiga. I was very interested and began working with Sam specifically on what the sound kernel was going to be like.

AW: So you and Sam began investigating various ways of controlling the Amiga sound hardware through software. How would you describe that hardware?

Bob: Probably the best way to describe it is like four looping "tape" players, which play a sound out of the computer's memory. That sound can come from anywhere, from say, a sampler—the tape recorder—which takes the sound itself and turns it into numbers that are put into memory, or from a synthesis program that computes the numbers directly. You can play up to four of those sounds—or the same sound—out of four different outputs assigned to stereo. Each of these so-called tape players has a volume control and a register that says where to start and stop, and how fast or slow to play it back. Software can interact very loosely or tightly with the synthesis, in that the hardware can go on its own, but more interesting sounds require more software control. You can simply play a sound, or for instance, if you want to add dynamics and character, then the software becomes more involved.

Sam: That's only if you want to add things to a sound—things that weren't in the actual recording in the first place before you put it in the computer's memory. A lot of applications are going to play recorded sounds, and those sounds can be anything from the simplest tone to a symphony orchestra.

Bob: You can record a dog barking or glass breaking or balloons popping—any sound you want—and then the software can manipulate it, or it can direct the hardware to manipulate it, like in playing pieces of it, for instance. It's a very flexible system. It's sort of like giving somebody a piece of paper and some scissors and a pencil and then saying, "Now, what can you do with that?"

AW: How does the quality of sound produced by the Amiga compare to that of professional synthesizers? I've heard comments that it never will measure up because of, among other things, a lack of specialized sound-processing circuitry.



Bob: In general, I would say that's true, but this machine has a lot of tricks because of the computer processing available. . . a lot of synthesizers use tricks too, so the question is whether the tricks that this machine can do can outrun the tricks that synthesizers can do.
Sam: Anytime you go to design synthesizers, you have a number of trade-offs. When you build a dedicated synthesizer you use a lot of custom chips—a lot of silicon devoted to making sound—which can have certain advantages. It's not trying to do graphics at the same time, for instance.
Bob: The architecture is very flexible. Something few people reading the systems specifications realize is what that flexibility can give you in terms of performance. It's a little hard to describe without getting very technical, but your ear can be fooled very easily, so if you use a lot of tricks on a sound, you can make the computer sound like it's much more sophisticated than it really is. Now, if you take only a simple sampled sound, then yeah, people will probably notice the limits to the fidelity, but if someone that's fluent with these tricks utilizes them well, they can fool people.
Sam: And even though few end users need capabilities like that, software developers can create libraries of these sounds. I have a sound library right here that includes some 40 sounds, any of which could be incorporated into any program, and some of them are quite complex.
AW: I heard the Amiga play a sampled version of the well-known Stravinsky Firebird chord, that big full-orchestra block of sound. I could have sworn it was the real thing. It almost rattled the windows.
Bob: The Amiga is very good at those sorts of sounds because they're very rich and they're very uniform. It does an excellent job.
Sam: One of the tricks that can make the ear think the Amiga has better sound hardware than the specs indicate has to do with the eight-bit waveform it uses when you're converting analog sound into digital numbers. With eight bits, you only have a possible 256 values to use to represent a sound event at any given time. The best sound quality in the recording industry is 16-bit resolution, which gives you 65,000 different values to work with—for the same sound.
Bob: When you have 65,000 values, if you have a quiet sound, it still has many levels to it, but if you have only 256 values and you have a quiet sound, maybe it will only have a dozen levels to it. So a quiet sound will sound very gruff on an eight-bit system, while on a 16-bit system, it will sound very clean.
AW: Rather like the difference between a little portable AM radio and a stereo system?
Sam: Right. When you have a sound that's fairly loud and it uses the full range of values, the noise is masked by the sound—you don't hear it because the sound is much louder than the noise. One of the tricks that can be done is possible because each audio channel in the Amiga has a volume control. Let's take the sound of striking a key on a piano, for example. Reproducing a sound like that on an eight-bit system is very difficult, because when the initial sound is made—when you first strike the key—it is very loud. It is important that the sound not overload the eight bits, that it stays within the 256 available values. When you get to the quiet portion of that sound as it fades away, it sounds very rough, very noisy. This is something that people who have worked with sampling keyboards are quite familiar with. However, if you are clever with the Amiga, you can take the sound when you record it and make the quiet portion louder so that the sound will always use the full 256 values, and in that way eliminate the noise.
Bob: When you record the sound, you turn the volume down at the beginning of the note—through software control—and then you turn the volume up as the note progresses. What you record is actually the same volume through the whole note.
Sam: If you played it back like that, it wouldn't sound much like a piano— it would sound more like an organ—because you've lost all the dynamics of the piano. But, since the Amiga has a volume control for each channel, while you're playing the note back, you can turn the volume back down again, and in fact put the dynamics back into the piano. In the quiet part of the note, when the volume would be soft just like the piano, so would the noise—because when you turn the volume down, you turn the noise down, too—and it would sound more like it has 12- or even 14-bit resolution even though you did it with eight bits. It also has the additional advantage that it requires less memory to store the sound in a true 12- to 14-bit recording.
Bob: The other thing that is possible, that sort of comes for free, is that there are four channels, and four channels gives you almost two more bits worth of dynamics. In other words, if you're playing one sound it will be one quarter as loud as playing all four sounds, so when you're playing all four sounds, you have almost 16 bits of dynamic range, and that's as good as a compact disc.
Sam: The way that Bob arrived at those numbers is that eight bits is for a single channel playing at a single volume. Since you have six bits of volume and your lowest volume still has eight bits of resolution, it's like having 14 bits. It's not exactly the same, ►

but it's close enough to fool the ear. And like Bob was saying, if you have four channels playing that loud sound, it can, in some cases, sound like 16-bit quality.

Bob: People working with the Amiga can be very surprised because it will have the same dynamics as a CD player even though it's using eight-bit samples, and if the sounds are designed carefully, your ear is tricked into thinking that the thing was the actual sound when what you're really doing is putting it together with a bunch of pieces.

AW: So software for controlling each voice's volume could be very important. Does the Amiga's open architecture mean that the entire system can be accessed by anyone, and are they limited to using the sound routines that you designed?

Bob: No. Essentially, third-party software developers can do anything they want. One of the nicest aspects of the Amiga is that it's very open. If you want to take over the whole machine and do it your way, you can. We tried to provide as much for people as we could without getting in their way, without forcing or limiting them.

Sam: Our philosophy in providing this tool, this computer, was to make it possible to do more than one thing at a time—to be able to have programs sharing the sound hardware, for example. Say you have one window with a terminal program that's connected to a time-sharing system, and while you're waiting for the host computer to solve some problem, you're running a music program on the Amiga. When the other computer finishes the problem, it beeps—you'll be able to hear that beep even though the hardware is being shared. That's something that we provided for.

Bob: A fun thing to do is to run the bouncing ball demo with its bounce sound and then open up a music program. You can sit there playing a guitar sound while the ball is bouncing. Those two programs don't know about each other and the kernel of the sound system has the intelligence to sort out who's going to play what sound when. What happens is the logical thing to happen, and in that case the bouncing ball has a lower priority, so if you play four notes, the bouncing ball sound goes away because the music has a higher priority and there are only four sound channels.

AW: But logic to a computer isn't always logical to the rest of the world. What is the logic here?

Bob: It's a pecking order, a priority list. The program says what priority it wants and then if another program claiming a higher priority comes in, it takes over. We've provided a suggested series of categories by rating applications.

Sam: In the most important category are sounds that are unable to yield—if they were interrupted it would be very noticeable—emergency situations, for instance, where immediate action is required. On the level below that are the bell sounds to get your attention, like the preceding example, and after that speech, either from the kernel software or some kind of recorded speech. Then come what are called sonic cues. These are sounds that provide some kind of information, perhaps something not provided by graphics, and then come musical notes. Further on down are sounds of action, like the bouncing ball, and then come background sounds, things you wouldn't miss much.

AW: So speech and music take precedence over the sound of the bouncing ball. How is speech accomplished on the Amiga? Is it digitized?

Sam: No, the speech is done from a model, from an analysis of a human voice. The people responsible for Amiga speech, Mark Barton and Joe Katz, actually build very small pieces of the speech waveform. They call the kernel routine to start sending them, and while the speech is occurring, their program goes back and figures out the next one, and so on. That way, they use very little memory.

Bob: If you're actually running the speech program with another program that uses a lot of the computer, you'll hear a break in the speech when it wasn't able to keep up—it crackles a little bit. Speech is very compute-intensive and it takes a lot of work to make those sorts of sounds. It's getting very close to the ultimate data compression and expansion system. Amiga speech takes a dozen or so characters and turns them into sound, which is actually thousands of bytes of information.

So essentially what you end up with is a series of tricks to produce specific sounds accurately, in this case speech. Some of the things Sam and I have been exploring are different synthesis techniques for different applications. Different instruments, for instance, are normally easy to synthesize in a specific fashion. The easiest way to synthesize most percussion instruments is to record them and play them back. Whereas, with something like a marimba, it's easier to synthesize it than it is to record it.

AW: Can the Amiga's internal voices sing a tune?

◄

Bob: Sure. You just use vowels and change the basic pitch of the voice between each "sentence." Amiga Basic comes with a program that lets you change the pitch. I've had a lot of fun typing in nonsense: I think "wawawawawawaw" is an interesting one. I don't know if it is supposed to sing, but it makes wonderful singing sounds.
AW: What about instrumental backup for the internal voices. Can that be done?
Bob: Yes, as long as you don't try to use more than the number of channels remaining. There are four channels out of the Amiga—speech can be on one or more of the output channels.
Sam: What is interesting, though, is working with sampled speech—as opposed to that built into the machine—to make it sing. This gives you much more control of the pitch and timing of the sung notes. You can sample, or record, someone saying something like "doo" and then tell the Amiga to play it back like this [*sampled voice rising in pitch as it sings*], "doo doo doo doo doo."
Bob: And it's completely musical because it's just a musical instrument you've created through sampling, although it sounds like it goes from a rather large person to a chipmunk.
AW: Look out, Alvin!
Bob: If you sample two or three people singing and you play two of these samples at the same time, with them not tuned exactly the same, so they're off by a few cycles, it sounds like a larger group of people. It's quite good.
Sam: There's a misconception about the fact that with four audio channels, only four simultaneous sounds or notes are possible. If you were to use sampling to record a three-note chord on one channel, then you could play all the notes in the chord using only one channel. That could save you two or three channels as opposed to playing each note of the chord on a separate channel.
Bob: So if you record a major chord and you play different notes, you'll get that major chord transposed. If you need a specific chord, you just play the sample for that chord. If you were to sample a major chord, a minor chord and a diminished chord—you would only need four or five samples altogether—you could do a multipart accompaniment using only one channel of the Amiga.

AW: What kind of musical flexibility is available from Amiga Basic as opposed to, say, C?

Bob: Actually, Amiga Basic is remarkably good, but in a strange way. It allows you to do a lot of common things easily, but if you have something that is unique, you have to know what you are doing. C allows you to do everything, but you need to know a lot more about the system to be able to use it.

AW: And the multitasking of the Amiga lets you do music with graphics without problems? That's not an issue?

Bob: Most of the time it's not, but it can be if your graphics take a lot of computing—that can slow things down. The music kernel receives messages that specify which notes to play, and for how long. It stores these messages in order until it is time to play them. If the sending program slows down, then the music will continue unaffected until the buffer is empty. With this approach, the graphics will not slow music down unless the kernel runs out of things to play.

AW: You've heard that old saw "If some's good, more's better." Why are there four sound channels in the Amiga—why not six or eight?

Sam: Sound channels are fairly complex modules and are truly independent. They even reside on separate parts of the chip. What I mean by truly independent is that they can run at different rates, and that they can work with the different samples. As a matter of fact, the hardware support for getting digital numbers to analog signals is done by four separate DMA ports.

AW: There are four digital-to-analog converters in the Amiga, then, one for each channel, and they all reside on the audio chip?

Bob: Yes. As I remember, about half of the chip is taken up just by those four converters, so to have eight, you would have to add another chip. The other issue is that in the hardware architecture, there are a lot of things that go on simultaneously with the sound, and it's organized so that everything fits very comfortably with everything else. It would be hard to squeeze in more channels.

Sam: Explained more fully, the microprocessor can take up to half of the available memory cycles and, with the standard Workbench screen, the video display takes the other half while it is displaying. There is a portion of time when the display is not reading memory. During this time the sprites, the disk and other critical functions have time to access memory. The four audio channels, at their highest rate, take everything that is left. So to have more audio channels, something would have to give.

Bob: One of the more interesting things about the computer is how neatly everything fits together. What's going on in there is a real zoo and everything has its time and place to do its thing. It's rather remarkable that you can get that much performance out of such a system. A lot of people have built very large systems—I call them brute force systems—to do basically the same thing the Amiga does. One of the reasons programmers like the machine is because it has so much available—it won't run out of steam the first time you try something. People are going to be coming up, for instance, with sounds using many new tricks, and they'll get sounds that nobody thought were possible. We've explored some of them, but in my mind it's going to be several years before there are programs that utilize the machine fully and stretch it to where it can go.

AW: Who designed the audio chip?

Sam: The principal architect of the machine was Jay Miner, but the person who designed the audio chip, "Paula," was Glen Keller. That chip, in addition to doing the audio, controls floppy-disk activities and the serial port. ►

AW: Can you see where Paula might be useful in something other than the Amiga?
Sam: One concept that is not generally understood is that these three chips are not separate products. They're more like one big chip that has been split up because of the limitations of what can fit on one chip. It's possible that with a special Agnes chip you could use more than one Paula if you wanted to make a dedicated music computer. With the Amiga's open architecture, one thing that could be done easily would be to use the MIDI adapter to connect the Amiga to other synthesizers.
AW: Yes, a number of developers are working in that direction, so that you can use not only the sounds provided by synthesizers, but the internal Amiga sounds, either or both.
Bob: It's very nice because you can use the Amiga sounds to get started, and then when you get more seriously involved, you can add more instruments external to the computer, and use the computer sort of as an accompaniment to those instruments. It expands very gracefully that way.
AW: As I understand it, sound sampling, the recording and digitizing of analog sounds, uses tiny pieces of sounds replayed so fast that they seem to be one piece.
Bob: When you sample a sound, you want to sample it fast enough so that, when you play it back, the ear doesn't hear little steps. To do that, you must sample at a rate that is twice as high as the highest frequency you want to use.
Sam: Have you ever noticed wagon wheels in western movies? As the stage coach starts rolling, its wheels start to speed up and all of a sudden they seem to slow down and start going backwards. Well, that's not going to ruin a movie, but when you're listening to a sound and the same thing happens, you'll notice it's not right.
Bob: The movie is made by taking pictures of the wagon wheel, for instance, at a fixed rate. This "sampling" of the picture image is equivalent to sampling audio. When sampling audio, as frequencies get higher than half the sampling rate, these frequencies start going backwards and they come down in frequency. So instead of everything going up as you play up the keyboard, part of the sound starts coming back down again. This all has to do with something called the Sampling Theorem—the rate that you sample at determines the highest frequency you can record. And since the Amiga samples, this theorem is very important here.

Let's say we've sampled a sound and we don't have any frequencies that will "fold" down. When it is played back, you have similar sorts of issues. The sampling rate

will determine what the pitch is. What is important is that the sample rate is always twice the highest frequency you hear. If you listen to the output of the digital-to-analog converters directly, the sound has little clarity and a lot of gruffness and edginess, caused by the steps that you didn't have in the sound to begin with. To eliminate this, you add what's called a smoothing filter, a low-pass filter, which takes the steps and smooths them out so that they essentially disappear. That's why all sampled systems have low-pass filters on their outputs. Since the sample rate on the Amiga is variable over a very large range, the low-pass filter has to remove this gruffness for all the frequencies of the lowest sample rate to be played. On the Amiga, its frequency is set to be one half the frequency of the lowest sample rate recommended. This allows approximately one octave output frequency range.

Sam: It's important, as Bob mentioned, to get rid of this roughness, but it's even more important to have different notes on the same instrument have the same basic quality. One of the things we realized early on was that people are going to want a certain range of control where they can change the sample rate to get different notes and not have the sound change in quality. We decided a useful range for this would be an octave. If a person wanted to play beyond that octave, they could play another sample recording.

One of the things that you can do once you've recorded a sound digitally is compute tables for different octaves. That's not always easy. For example, if you took the sound of a violin and slowed down the sampling rate, instead of it sounding like a violin playing lower notes, it would sound like a larger instrument, more like a cello.

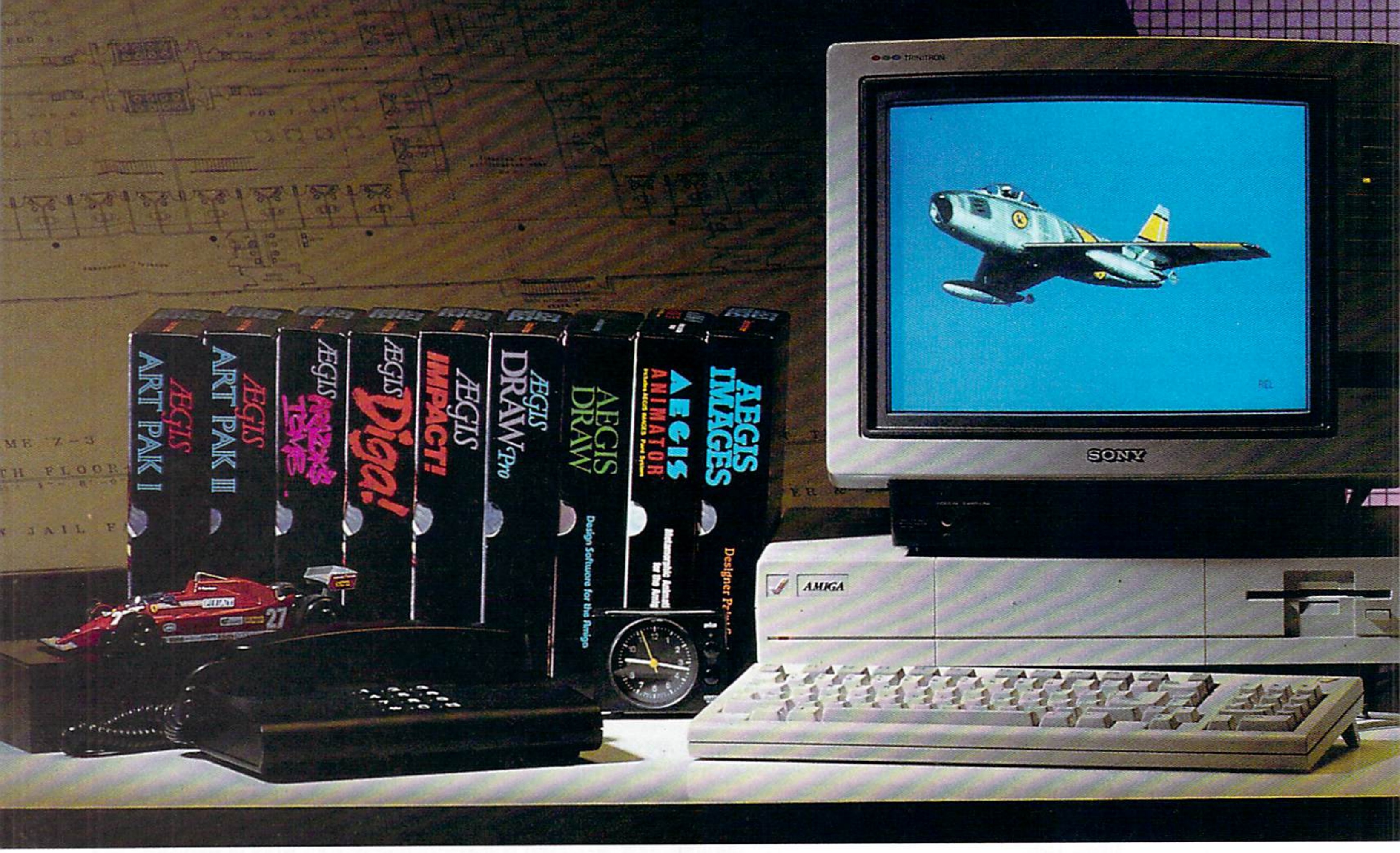
Bob: So when you raise or lower the sample rate, you can actually compute a compensated sound that has corrections to the instrument, knowing that it isn't really getting larger—it's just playing a lower string.

Sam: A lot of techniques like this have been developed using large computers over the last ten years in laboratories around the world. The Amiga has the ability to perform calculations very quickly and can take advantage of some of these sophisticated techniques.

Bob: That's one of the reasons, as I said, that we don't really know *all* the ways people are going to make sound with the Amiga—there are so many possibilities.■

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ÆGIS gets graphic



Only rarely in the evolution of the microcomputer has truly great hardware been matched with truly productive software. Amiga meets Aegis. Software so intuitive the Amiga becomes limited only by your imagination. Aegis now has nine graphic reasons why you should be creating with Commodore's Creative Edge:

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Digital Sound Synthesis

Using Amiga Basic's flexible sound commands, you can easily add digital sounds to your programs.

By John Foust

Today, digital sound is everywhere—in compact-disc audio gear, in the recording studio and inside the Amiga. The Amiga's powerful sound synthesis is based on digital sound, the same principle at work in the hottest new stereo equipment.

Conventional stereos represent sound as a continuously changing wave. This is analog sound. The sound you hear is only analogous to the original sound. An analog tape recorder represents sound on tape as a continuously varying magnetic field. In analog recording, every component along the way—such as microphones, amplifiers and speakers—tries to mimic the original sound, as a wave of electricity, or a pressure wave in air.

If we view sound on an oscilloscope, we see these continuous waves. A pure sound, like a reed instrument playing a single note, has a gentle, wave-like curve. The sound of a drum shows a jumble of jagged peaks and valleys, a characteristic of noisy sounds.

Digital sound creation is based upon a principle that is vastly different from that of analog sound creation. Instead of mimicking the original sound wave, the sound is represented by streams of numbers. In digital recording, the amplitude of a sound is measured thousands of times a second, at a constant rate. Taken as a whole, this stream of numbers represents the sum of all parts of the original sound, including pitch, vibrato, and whether a chord or single note was played. A digital sound player recreates the original sound by converting the stream of numbers into continuous sound waves. (See Figure 1.)

The Amiga sound chip processes a digital sample more than 29,000 times a second. In comparison, a compact-disc player plays another sample more than 44,000 times a second, with a corresponding increase in fidelity. Human speech becomes hard to recognize when sampled at less than 8,000 times a second. Most intercontinental telephone calls are transmitted as digital samples.

The Amiga can play back sampled sounds, like a digital recorder. In fact, this is the only way it can create sounds. Whenever the Amiga makes a sound, it is scanning and playing back a table of numbers that represent a sample of that sound.

Computers have an advantage in digital sound synthesis. Since the sound is a stream of numbers, the computer can create a different sound based on a new stream of numbers. The new sound might sound like a real-world sound, such as a pipe organ, or it could sound artificial, or "synthesized." The Amiga's ability to speak is a synthesized sound, modeled after human speech.

The Amiga's digital sound chip, code-named Portia during the design process, can play four streams of digital sound at once, in stereo. Each voice plays its own table of numbers.

You can create your own sounds by creating these tables of numbers. Some music programs let you draw a waveform of a new sound and use it to play music. These programs create the table of numbers that represent your new sound, which is in the form needed by the sound chip.

Most Amiga computer languages include sound commands. Short programs in Basic are the easiest way to explore the Amiga's sound capabilities and learn about sound synthesis, to boot. While other languages might have more computing power, Basic shines in interactive learning tasks like this. To demonstrate Amiga sound creation, let's use Basic to create a simple sound.

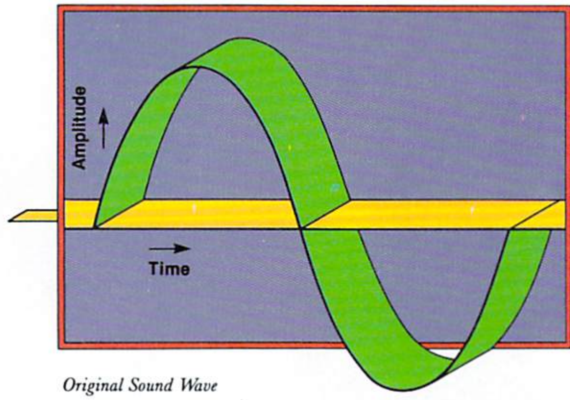
These examples are given in Amiga Basic, the version of Basic supplied with your Amiga. While other versions of Basic may have a different syntax for sound commands, the principles of Amiga sound creation remain the same.

Amiga Basic has two central sound commands—Sound and Wave. These commands give the Amiga a description of the sound we wish to create. In fact, similar Sound and Wave commands are present in ABasiC, another version of Basic for the Amiga.

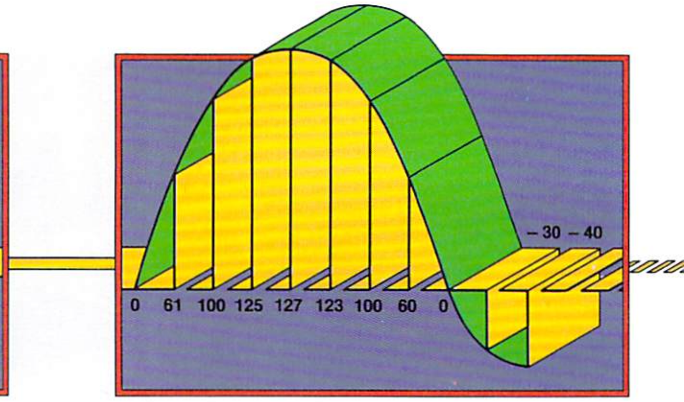
The Sound command describes the pitch, duration and volume of a sound and sends this sound to the ►



Illustration by Stephen Lyons



Original Sound Wave



Digital recorder samples the sound at equal intervals in time, and assigns a number to the measured volume.

Amiga sound chip. The Wave command assigns a table of sound values to a given Amiga voice on the chip.

The most obvious characteristic of sound is pitch, which is the difference in sound frequency that we hear as distinct musical notes. Not surprisingly, the first number in the Sound command specifies pitch. The second is the length of the note. The Sound command plays a single note for a given time.

In technical terms, a pitch can be measured in two synonymous ways—by frequency or by period. The period of a wave is the time between crests of the wave; the frequency is the number of waves that repeat in a given time. The two measurements are inverses of each other, so if you know the pitch of a sound, you can calculate its period.

To play each note of the scale using a given sound, only one table of numbers is needed. If the Amiga sound chip samples the table at a certain speed, we might hear the middle C note. If the chip samples at twice that speed, we would hear a C note again, but this time the note would sound an octave higher on the scale. By changing the rate at which the sound chip scans the table, we can change the pitch of a sound.

In the Sound command, a smaller number means a lower pitch and a larger number means a high sound. Middle C is a value of 523, and this number must be between 130 and 2,000 for most musical sounds. The special sounds for a video game might have pitch numbers between 20 and 15,000.

Some sounds do not have a constant pitch; the pitch changes over time. For example, a police siren changes pitch over time, first climbing to one frequency, then dropping in pitch to another.

The police siren sound presents a problem to the Sound command. If the Sound command can only play a note of a single pitch, how can it reproduce a police siren?

To generate sounds that change in pitch, the Police Siren program (p. 37) plays a series of short notes, each changing in frequency by a small amount. The increment can be small enough that your ear can't detect the change in pitch, so the sound changes continuously.

In musical terms, this rate of change describes the speed of a portamento, or a glide between two notes. This glide is the sound effect necessary for the police siren.

The second Sound argument is the duration of the sound, a value from 0 to 77. A large-numbered value would play for a longer time, up to nearly four seconds for a value of 77. A value of zero won't play any sound. Since the police siren sound needs many short segments of sound, the example uses a duration of 1.

The third Sound number is the volume of the sound, a number from 0 to 255. Zero means no volume, or no sound at all. The last number tells which of the four available sound channels, or voices, will produce the sound.

Remember, the voices are numbered from 0 to 3. The right speaker plays voices 1 and 2. You must have your Amiga audio jacks connected to your monitor with a Y adapter, or you will hear only one channel of sound.

A second characteristic of sound is the shape of the wave that makes the sound. As mentioned above, many sounds have a gentle, curved wave, while others are known by jagged-edged waves.

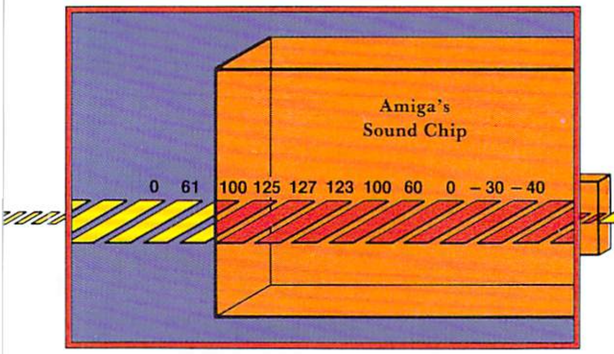
Using the Wave command, we can set up a table of numbers that represent the wave shape of the new sound. The Wave command takes two arguments. The first is the voice number, from 0 to 3. In other words, you can play up to four sounds at once, each with a different table.

The second Wave argument is the name of the integer array that holds the values. This array should contain at least 255 values. A larger number of values in the array gives a better sound. If the table represents the amplitude of a smooth wave measured over time, a larger table holds more measurements and the sound is more accurately described.

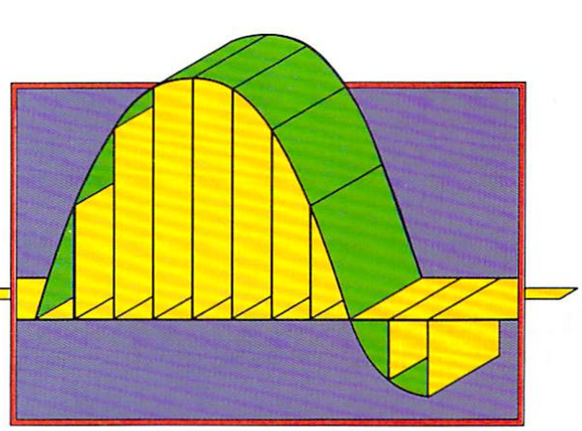
Amiga Basic allows the word Sin instead of an array name in the Wave command. If Sin is used, Basic generates a table of values representing a rolling sine wave. The program need not generate a custom array of values. For the police siren, a Sin wave table is used.

The first line of the Police Siren program assigns a Sin sine wave table to voice 0:

```
WAVE 0, SIN   :REM Set up a sine wave table
```



The original wave is represented as a stream of numbers.



A digital sound player, like the Amiga's sound chip, reconstructs the original sound from the stream of numbers.

Next, the Sound command is executed 120 times, with frequency values increasing from 1,000 to 1,200 by tens. The duration of each sound is small (a value of 1, or about 28 per second). The volume is set at 100, playing on voice number 0:

```
START: FOR I = 1000 TO 1200 STEP 10
            SOUND I, 1, 100, 0
       NEXT I
```

The next line instructs Basic to wait until the previous 120 notes have stopped sounding. The Sound command really queues every sound request, so the rest of the Basic program can continue to run—sort of like walking and chewing gum at the same time.

```
SOUND WAIT   : REM Wait for rising sounds to stop
```

After the rising tones have played, the next For loop plays the falling part of the siren sound. Note that the Step size decreases by 20 until it reaches 1,000, the pitch the siren started at in the first For loop:

```
FOR I = 1200 TO 1000 Step -20
    SOUND I, 1, 100, 0
    NEXT I
```

The Sound Resume statement allows subsequent Sound commands to play immediately, the opposite of Sound Wait.

```
SOUND RESUME   : REM Play new sounds right away
```

After completing one rise and fall sequence, the program loops forever. Pull down on the Run menu item called Stop to halt the program.

```
GOTO START   : REM Jump back, do it again
```

Many sounds are composed of an additive combination of sine waves. To achieve more realistic sounds, you might try playing two or more Sin sounds at the same time, with slightly different frequency values. Your ear will combine the two sounds into a single, richer sound.

```
        WAVE 0, SIN              : REM Set up a sine wave table
START:  FOR I = 1000 TO 1200 STEP 10
            SOUND I, 1, 100, 0
        NEXT I
        SOUND WAIT               : REM Wait for rising sounds to stop
        FOR I = 1200 TO 1000 STEP -20
            SOUND I, 1, 100, 0
        NEXT I
        SOUND RESUME             : REM Play new sounds right away
        GOTO START               : REM Jump back, do it again
```

Listing 1. *Police Siren program in Amiga Basic.*

More complex sounds have still more subtle changes during the time a note is played. A gong sound changes pitch over time, but it also changes in volume. To produce sounds that change in volume, a program could use the same trick as the Police Siren program. By playing many short segments of the same sound at different volume levels, a sound could change volume over time.

Real-world sounds are composed of many small changes in pitch and volume. The characteristic wave shape changes over time, too. By changing pitch, volume and the Wave table, the Amiga can recreate very realistic sounds.

A bass drum sound has a very jagged waveform. Its volume is loudest at the moment the drum is struck. To translate this to Amiga Basic commands, the Wave table would be composed of nearly random numbers. The Sound command would set the volume to maximum, and the program would play short snippets of the drum Wave table, each at a slightly smaller volume level.

Although the Amiga Basic manual can be imposing at times, the principles of digital sound synthesis on the Amiga are simple. The sound commands are flexible enough for both beginners and experts. With a little practice, you can add digital sounds to your Amiga Basic programs.■

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Professional Musicians and the Amiga

By Peggy Herrington



Musicians Mike Boddicker and Tom Scott talk about how the Amiga's technology is changing the way they make music.

It was almost a year ago that the Amiga was launched at a glittering affair in New York City. Yes, almost a year ago that Mike Boddicker and Tom Scott played their first gig with a very special piece of music technology. And when I met with them in early 1986, they were still awaiting a second, more intimate, chance to perform with it again.

The subject came up almost as soon as we were settled into Tom's music studio on the ground level of his three-story home in Hollywood. We had just seen a preview of Mimetics' music-sequencing program for the Amiga when Mike remarked, "You know, it's a little frustrating to see this stuff developing and know it's going to happen, and know that you want to build your life around it, but you can't get your fingers on it."

Despite the fact that he had virtually no Amiga software at the time, Mike Boddicker has a lot of savvy when it comes to electronics. He's a top studio synthesist, having composed and played sound-effects and music tracks for hundreds of television commercials and motion pictures, including *Buckaroo-Banzai, Flash Dance* and *The Magic Egg*, a diorama for which he composed and recorded the original multilayered sound track. Tom Scott began exploring synthesis in his well-equipped studio several years ago, but has approached professional music in a somewhat more traditional way—if you can apply that term to jazz—specializing in flute, saxaphone and the Lyracon. Eighteen Gold and Silver Records adorn the walls of his studio in silent tribute to his expertise. His studio also includes an Amiga, and I asked Tom how he'd been introduced to it and how he uses computers in general.

"What actually started it all was that show we did," he said, smiling at his friend. "When Mike Boddicker asked me to go to New York with him and help premier the Amiga and some of its potential software, I started getting interested. In asking around it became clear to me—because of the software shortage at the beginning, and yes, still now—it became clear that I was not going to be able to jump right in with the Amiga. After some investigation, I found that several of my friends, L.A. studio musicians, had Apple IIe's, so I got one.

"Over the past few months, I've used three programs extensively. Appleworks has a database, spreadsheet and a word processor that work very well for my needs, and DX Pro stores DX7 sounds and lets me read its



Tom Scott

settings on the screen and store hundreds more sounds. The third one is the Film Music Tool Kit, which is basically a music click-track program calibrated in frames per beat—it's a film composer's metronome. It will spread out a music cue for you and delineate all the significant timings you need to hit. As a composer, you need to know where certain bits of action or dialogue occur within a scene that has music. Once you decide where these points are, it's very easy to then tell the computer, 'Okay, if it starts here and goes at this tempo, where will events one, two, three and four hit as the scene progresses?' It blocks it all out for you."

"Then you can toggle back and forth between tempos to find what tempo catches most of the things you need to hit and adjust it from there," Mike added.

"Doing that manually takes a long, long time," Tom said. "Anyway, with those three programs, I feel I'm off to the races and, of course, that takes me to the Amiga, which is, in a sense, light-years beyond that."

"Beyond the Apple IIe, that's for sure," Mike remarked, and we chuckled in agreement.

I asked Mike how he uses a computer. "I got an Apple IIe about the time they became available," he said, "and started using it with the MSQ Sequencer to dump sequences I had written and print parts for musicians on jobs. I found it was one of the most useful things I'd ever run across for doing that. Just the other day a composer I was working with did the same thing. He wrote all the jingle parts into the computer and then printed the score and individual parts. He said it's taken him a while to get used to it, but it's getting so fast for him now it's not anywhere as tedious as writing them out by hand. And I consider the sequencers I use to be computers, too. They've certainly changed the way I do my music."

Sequencers house microprocessors and allow musicians to digitally record music in sections from music synthesizers attached via MIDI. They can then adjust such aspects as instrumentation (also referred to as timbre or color) and layer sequences into multipart musical wholes.

"I really got into sequencers when I did *The Magic Egg*," Mike continued. "It changed the way I work. That was about two years ago, and I had been holding off because there were several other people in Los Angeles who had been utilizing sequencers extensively, and well, first off, I thought their music sometimes sounded really sequenced, too fast and choppy, and the phrasing wasn't correct."

That made me think of music I myself had entered in a computer, and I remembered how stiff it sounded compared to playing it on the piano.

"Stiff and mechanical-sounding," Tom said, taking the words right out of my mouth. "And including things no musician could physically play."

"I also didn't want to quit playing live," Mike said. "I was afraid that if I used sequencers a lot, I wouldn't get the chance to play with groups as much as I have. I want to keep my chops up."

"Sometimes technology can trap you," Tom explained. "If Michael had become known as a sequencer musician, or if he had become too involved with it, he would have sacrificed many opportunities to play along with a group. He could have become a music programmer, which is okay. . . ."

"If you want to become a music programmer," I finished for him.

"Right," he said.

"So I was holding off for all those reasons," Mike continued. "But with *The Magic Egg*, there were many things I wanted to do that I couldn't do any other way, like harp glissandi and a lot of bell parts and things that I could have played only in half-time with the accuracy I wanted. It turned out that I found ways to manipulate the synthesizers so the music didn't sound so sequenced. I used delays and different chorusing units, and techniques in programming the sequencer itself, like changing the patterns often. That way, the music came out sounding more human than machine."

That is a good example of the control and freedom that electronic synthesis and MIDI have given musicians as a whole. But a lot of responsibility has accompanied it. If you get the opportunity to experience *The Magic Egg* (and that's what it is as far as I'm concerned, an experience), you may find it hard to believe that a single individual—Mike Boddicker—conceived, composed and performed all the music in its entirety.

"That must have had quite an impact on the way you work," I said.

"Oh yes. In fact, it causes me a lot more work now," Mike said. "You see, now I can call up a sequence or two that I wrote earlier and have them running while I play another ►

"The Amiga is going to change, radically change, the way we do our music."



Mike Boddicker

part on top. Lots of the composers I work with want me to do that, so I end up playing three or four parts instead of just the one that I used to. It does have that drawback, which is not necessarily a drawback for me."

I had heard that sentiment expressed by other musicians as well. There's a certain satisfaction to be derived from doing it all (or most of it) yourself, having the talent, experience and equipment to perform not only your own part, but that of others. And of course, it's easier and more expedient (not to mention more remunerative) to play along with your own prerecorded accompaniments than to coordinate them with other musicians on the spot. But what about those other musicians? Where are they performing while you're doing it all with your electronic equipment?

"Digital sampling," I said, thinking of a related aspect. "What about that?"

"It's very significant and very useful," Tom replied. "It's also very controversial."

Mike knew exactly what he meant. "If you're talking about replacing an oboe or a saxaphone. . .I mean, Tom, you know you can't replace a saxaphone. There are too many inflections. Every other note is a different color."

"It's not necessarily saxaphones, not just instruments I play," Tom said. "I've seen cases—and been a party to them, frankly—where a player was supplanted. There was one less player on a date because a good sample was available."

"I've also seen it happen that a composer was able to use another color by using a sample, when he wouldn't have had the budget to get another player," Mike replied.

"That's absolutely true," Tom said, "and that's the up side of the issue."

"As far as sampling with the Amiga goes, I thought it was a lot of fun," Mike said, recalling the demonstration we had seen earlier. "That I don't have the equipment to use it on records now is my major complaint. I'm looking forward to getting that stuff, and as soon as I can sample and manipulate sound with it, I'll use my Amiga right along with my Emulators."

"And I really am in favor of this mouse," Tom said, pointing at his computer system. "I think music people who become fans of computers will use them. I know you can do the same things from the keyboard, but I love using those two little controls and shooting things around the screen."

Mike agreed. "I want to get a modem hooked up and happening, too. Say Tom and I want to work on a piece together, we could send things back and forth between our houses. Not just the files for the notes and sounds, but everything, which I see as being very useful. I remember when we did the Amiga launch, we had to fly cassettes of data by overnight express to New York. It would have taken three minutes instead of 24 hours if we'd had a modem."

"With that you have the possibility of co-composing over long distances," Tom added. "It's thrilling to think about it. No more of this playing it over the phone by holding a receiver up to a speaker."

"Right. With that and the music programs we know will be available and the fact that you can access them on the Amiga, plus a librarian program and a phone book at the same time, plus using Gen-lock to put a video on the screen while you do the music for it, it's gonna be incredible," Mike added.

Tom continued where Mike left off. "We're talking about a massive, all-purpose unit. Running those programs at the same time and shuffling back and forth among them."

"I just wish they'd get it together faster," Mike lamented.

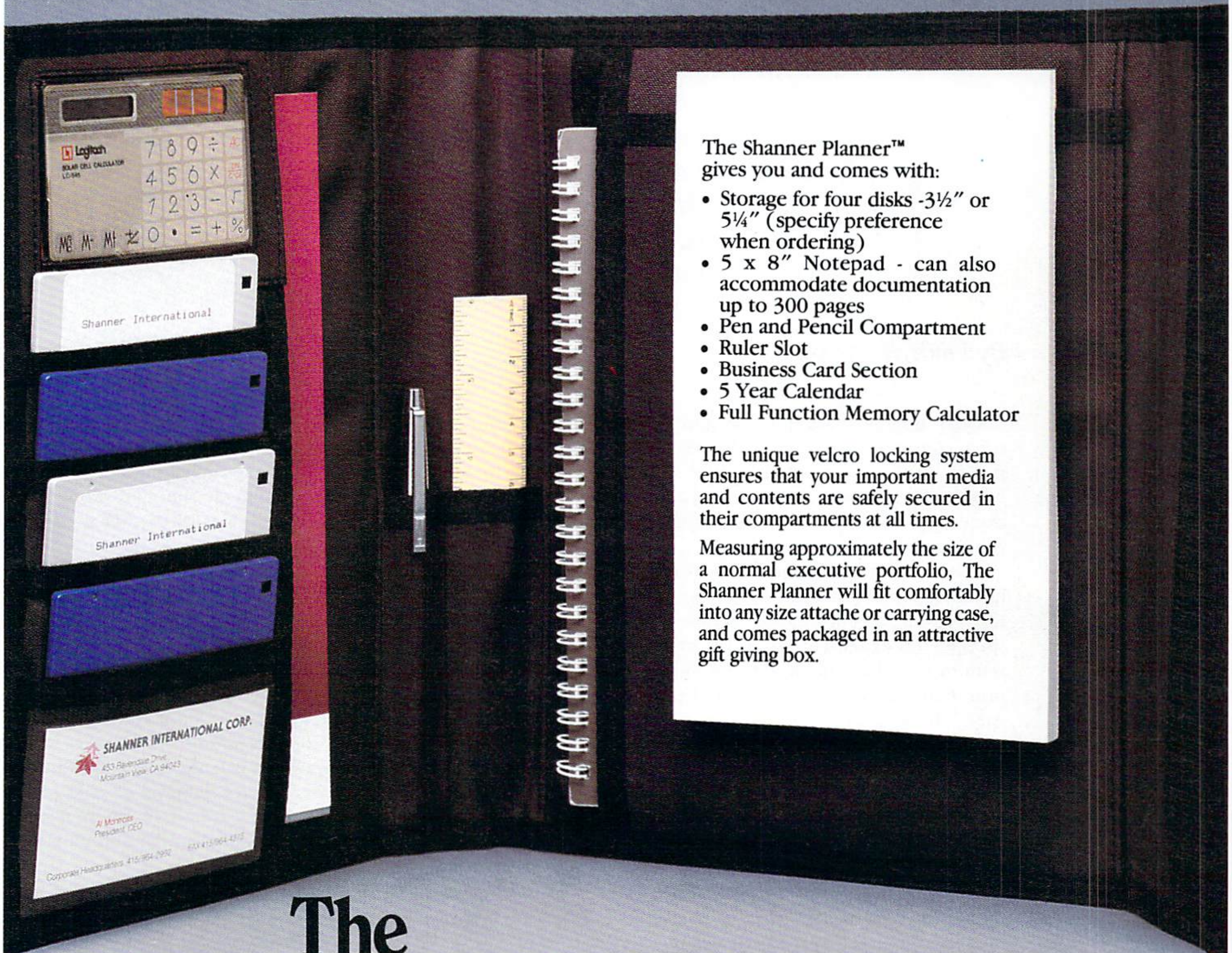
"As far as I'm concerned, it's worth the wait, however long it takes," Tom said to Mike. Then he turned to me. "We're just slightly excited about the potential," he said, and we laughed at the understatement.

"The Amiga is going to change, radically change, the way we do our music," Mike said smiling. "We're looking forward to that."■

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Making Music with Amiga Basic

Amiga Basic has only two music commands, but you can use them to get some impressive sounds out of your machine. Here's a look at those commands, plus a simple note-playing subroutine.

By Louis R. Wallace

When it comes to sound and music, no other personal computer even approaches the Amiga in terms of power and flexibility. Its four-voice stereo output combined with a dedicated synthesizer allows the Amiga owner to break new ground in the area of computer-generated sound.

Already, a wave of sound and music programs is heading towards us, and we can expect this to continue for years to come. But not everyone wants or needs this special (and expensive) software. Some users simply want to be able to incorporate some sound and music into their Amiga Basic programs. Let's look into what Amiga Basic offers in terms of music commands.

Unfortunately, Amiga Basic offers very little in the way of sound and music instructions. This is surprising when you consider the wealth of other commands available to the Amiga Basic programmer for graphics, animation and data manipulation. For some reason, music and sound was limited to only two commands. We cannot create our own envelope or ADSR, there is no option for filtering, etc. ABasiC, the version of Basic for the Amiga developed by Metacomco, offers much more flexibility and power in terms of music and sound; however, it lacks a number of the other good features that are present in Amiga Basic.

Even though they are limited, the two Amiga Basic commands can be used for producing very nice sound and musical notes. The two commands are Sound (frequency, duration, volume and voice) and Wave (voice and wave array).

The Sound Command

The *frequency* used in the Sound command ranges from 20–15,000 Hz. There is a table in your Amiga Basic manual that gives the frequency required for several octaves of the diatonic music scale. These are the seven notes A, B, C, D, E, F and G. With these frequencies, you can determine what is required for any diatonic note in any of the available nine octaves possible in the 20–15,000 Hz range by simply dividing or multiplying one of the table values by two. That's not too bad. But it doesn't allow for any of the other possible notes that lie between the diatonic notes—these are the five sharps and flats, and they cannot be as easily calculated from the table. Without them, your music programs would be limited.

The second sound parameter is the *duration*. This is a number that ranges from 0–77, and it determines how long the given frequency will be played. The value 18.2 is about equal to one second of sound.

The *volume* parameter is from 0–255, allowing you to easily and precisely control the level of sound for voice, the last parameter. *Voice* is from 0–3, where 0 and 3 are played on one stereo channel, and 1 and 2 on the other.

While you can use the command as is to play notes, it would have been much easier to offer the option of simply playing a C# or G instead of a frequency of 635.71. And while you can use the duration value of 9.1 to play a note for half a second, it would have been better to perhaps play a quarter or eighth note instead. And in real music, the length of time these notes would play is based upon the tempo desired. So sometimes an eighth note plays for one duration, sometimes for another.

The solution I came up with was to write a subprogram that will allow the writing of Amiga Basic programs that use more normal musical notation for the notes, and that will allow the use of sharps and flats. And to be really useful, it should have the added flexibility of allowing you to define your tempo in Beats Per Minute (BPM) and the time signature. The time signature is musical notation that declares which note is equal to one beat. So, if your time signature is ¼, a quarter note will have one beat, a half note two beats, a

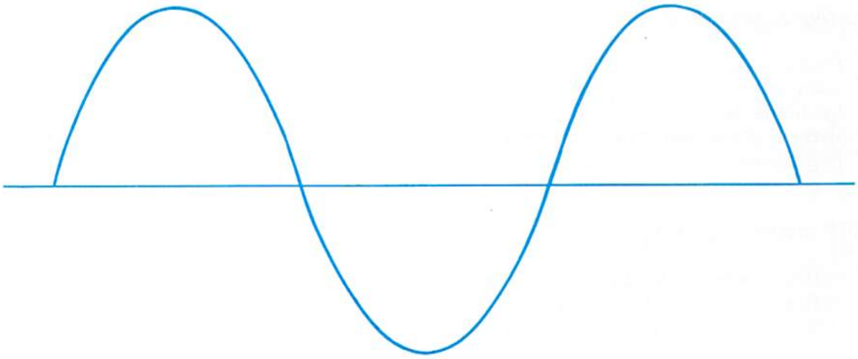
whole note four beats, an eighth note one-half beat, and so on.

The demo program (Listing 1) demonstrates the use of the Playnote subprogram. Subprograms are special forms of subroutines that can be completely independent of your program. Their variables can be local to the subprogram or global (shared). You access the routine by using the Amiga Basic command Call, followed by the subprogram name and a variable list. In Playnote, we pass several variables. One is Note$, which is one of the possible 17 notes (seven diatonic, five sharps and five flats). The note can be uppercase or lowercase; a sharp is followed by # (the number sign) and a flat is followed by a – (minus sign). The subprogram will calculate the proper frequency for the note from that.

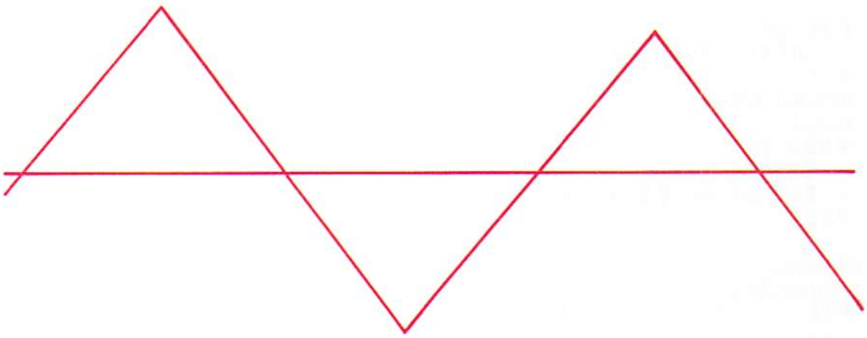
The next parameter is *octave*, which is a number from 0–8. This will cover all notes in the 20–15,000 Hz range. Next is *notelength*, which indicates which type of note (whole, half, quarter, eighth, etc.) you want. You use the inverse for notelength, so for a whole note use 1, for a half note use 2, for a quarter note use 4, and so on. Finally, you pass the *volume* and *voice*, where volume is 0–255 and voice is 0–3. In the demonstration program, each note is played by all four voices in order to give a richer, more dynamic sound. (If you want to Pause, send a dummy note with the duration you wish and a volume of zero.)

You also have two shared variables. These are defined within the main program. They are called Onebeat and BPM. They allow you to define your tempo in Beats Per Minute (BPM) and direct which note type gets one beat. This allows you great flexibility, as you can

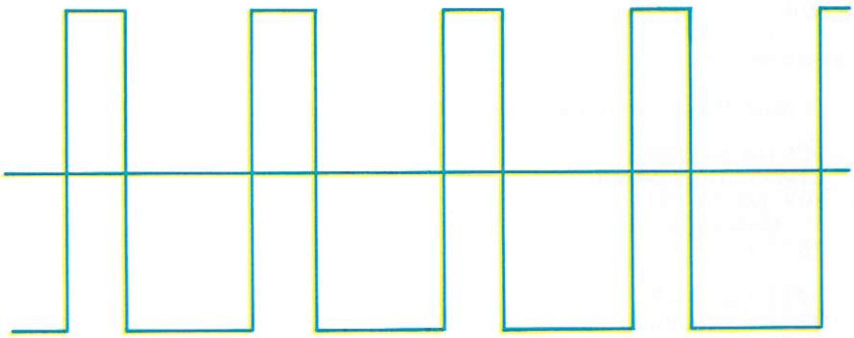
►



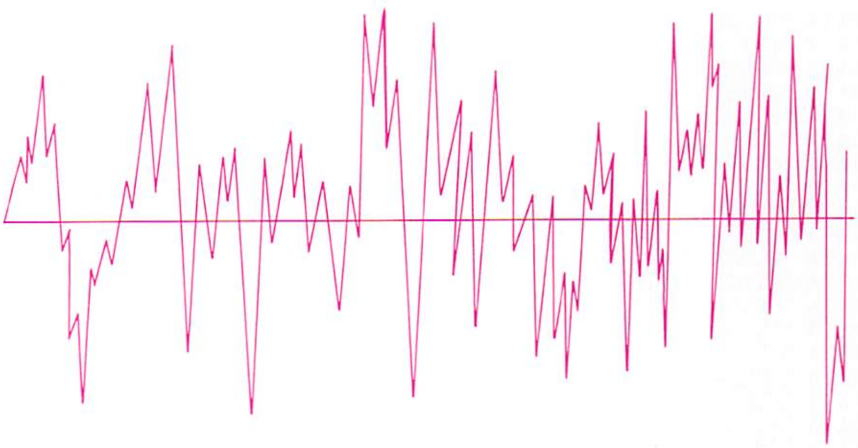
Sine Wave



Triangle Wave



Pulse Wave



Noise Wave

Listing 1. Demo program.

```
' Demo program to play musical notes from AmigaBasic
' using a subprogram approach
' by Louis Wallace 2/19/86
' with a little help from my friends
' Peg Steimer, Sam Dicker and Mike Boom


DIM note$(23),octave%(23),notelength(23)

' define onebeat for default beat using inverse ( 1/2=2, 1/4=4 etc )
' define Beats Per Minute (BPM)
' these are user selectable parameters required by subprogram

onebeat=4   ' time signature
bpm=115     ' tempo

GOSUB makewavearray   ' define waveform

 FOR d=1 TO 23
     READ note$(d),octave%(d),notelength(d)
 NEXT
 SOUND RESUME
 test=1
 WHILE test>0        ' play it over and over
    GOSUB playsong
    FOR delay=1 TO 10000:NEXT delay ' delay before restarting
 WEND

playsong:
 volume=255
 FOR i = 1 TO 23
 FOR voice= 0 TO 3
     CALL playnote ((note$(i)),(octave%(i)),(notelength(i)),(volume),(voice))
 NEXT voice
     FOR t=1 TO 500:NEXT t  ' delay between notes
 NEXT i
RETURN

 makewavearray:

   ' create timbre array for wave definition

   DIM timbre%(255)
   K#=2*3.14159265#/256
   FOR i=0 TO 255
       timbre%(i)=31*(SIN(i*K#)+SIN(2*i*K#)+SIN(3*i*K#)+SIN(4*i*K#))
   NEXT i

   WAVE 0,timbre%
   WAVE 1,timbre%
   WAVE 2,timbre%
   WAVE 3,timbre%
   ERASE timbre%
   RETURN

DATA "d",2,2
DATA "d",3,2
DATA "c#",3,4
DATA "a",2,8
DATA "b",3,8
DATA "c#",3,4
DATA "d",3,4
DATA "d",2,2
DATA "b",3,2
DATA "a",3,1
DATA "b",2,2
DATA "g",2,2
DATA "f#",2,4
DATA "d",2,8
DATA "e",2,8
DATA "f#",2,4
DATA "g",2,4
DATA "e",2,4
DATA "c#",2,8
```

Listing continued.

White Noise

```
DIM NOISE%(256)
FOR I=0 TO 256
NOISE%(I)=INT(RND(1)*128)-128
NEXT I
WAVE 0, NOISE%
ERASE NOISE%
```

Triangle

```
DIM TRIANGLE%(256)
COUNT=0
FOR I=0 TO 127 STEP 2
TRIANGLE%(COUNT)=I
COUNT=COUNT+1
NEXT I
COUNT=64
FOR I=126 to -127 STEP -2
TRIANGLE%(COUNT)=I
COUNT=COUNT+1
NEXT I
FOR I=-126 to 0 STEP 2
TRIANGLE%(COUNT)=I
COUNT=COUNT+1
NEXT I
WAVE 1, TRIANGLE%
ERASE TRIANGLE%
```

Pulse Wave

```
DIM PULSE%(256)
FOR I=0 TO 63
PULSE%(I)128
NEXT I
FOR I=64 TO 191
PULSE%(I)=127
NEXT I
FOR I=192 to 255
PULSE%(I)128
NEXT I
WAVE 2, PULSE%
ERASE PULSE%
```

Sine Wave

```
DIM SINARRAY%(255)
COUNT=0=
FOR I=0 to 2047 STEP 8
SINARRAY%(COUNT)=INT(SIN(I)*128)
COUNT=COUNT+1
NEXT I
WAVE 3, SINARRAY%
ERASE SINARRAY%
```

change the tempo and time signature within the main program whenever you wish, and the Playnote subprogram will act accordingly.

The Wave Command

The other Amiga Basic sound command is Wave. Wave allows you to define the waveform used by a voice. In the demo, I use the subroutine *Makewavearray* to define an

array consisting of a very complex sine wave. (The formula for this is the same one found in the Music Demo on your Amiga Basic disk in the BASICDEMOS directory.) The array used to define the wave must consist of at least 256 elements, and also must be an integer array. That's why in the demo, Timbre% contains the % symbol, which indicates integer. The array can be larger than 256 elements. The elements of the array must also be within the range of −128 to +127.

If you wish, you can use the default array of Sin, which is a simple sine wave. Or you can create a subroutine to make different types of waves. For instance, you can easily define a square (pulse), triangle, sawtooth or noise from within your program.

I've included some simple routines (p. 44) to make some waveforms other than Sin or Timbre%. Of course, these are only simple examples of the almost infinite number of waveforms you can generate. Try them out, and then start making your own.

I hope you find the Playnote subprogram useful. Those who are musically inclined will almost certainly find areas where it can be improved, but it is a good base from which to begin.■

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Listing continued.

```
DATA "d",2,8
DATA "e",2,4
DATA "f#",2,4
DATA "d",2,1

SUB playnote (note$,octave%,notelength,volume,voice) STATIC

SHARED onebeat,bpm
    IF notelength<0 THEN getout
    IF volume<0 OR volume>255 THEN getout
    IF octave%<0 OR octave%>8 THEN getout
    IF voice<0 OR voice>3 THEN getout
    IF note$="a" OR note$="A" THEN note=0:GOTO play
    IF note$="a#" OR note$="A#" THEN note=1:GOTO play
    IF note$="b-" OR note$="B-" THEN note=1:GOTO play
    IF note$="b" OR note$="B" THEN note=2:GOTO play
    IF note$="c" OR note$="C" THEN note=3:GOTO play
    IF note$="c#" OR note$="C#" THEN note=4:GOTO play
    IF note$="d-" OR note$="D-" THEN note=4:GOTO play
    IF note$="d" OR note$="D" THEN note=5:GOTO play
    IF note$="d#" OR note$="D#" THEN note=6:GOTO play
    IF note$="e-" OR note$="E-" THEN note=6:GOTO play
    IF note$="e" OR note$="E" THEN note=7:GOTO play
    IF note$="f" OR note$="F" THEN note=8:GOTO play
    IF note$="f#" OR note$="F#" THEN note=9:GOTO play
    IF note$="g-" OR note$="G-" THEN note=9:GOTO play
    IF note$="g" OR note$="G" THEN note=10:GOTO play
    IF note$="g#" OR note$="G#" THEN note=11:GOTO play
    IF note$="a-" OR note$="A-" THEN note=11:GOTO play
getout:
    EXIT SUB
play:
   freq=27.5*(2^(octave%+note/12))
   timing=((onebeat*60*18.2)/bpm)/notelength
   IF timing>77 THEN timing=77
SOUND freq,timing,volume,voice
END SUB
```

C Basics

By Mark L. Van Name and William B. Catchings

Introducing a four-part tutorial series on programming in C. This first installment covers the basics of the C language.

For some Amiga owners, off-the-shelf software packages will meet all of their computing needs. For others, however, the ability to write their own programs is crucial. There are a number of program development languages already available for the Amiga. One of these, C, is a powerful development language in which much of the Amiga's system software was written.

In this four-part series, we will discuss how to use C on your Amiga. We will introduce you to the language and provide a tutorial on its basic constructs and use. In the first three installments, we will discuss aspects of C common to most versions. In the final installment, we will include some information specific to the Amiga in order to allow you to write programs that take greater advantage of the system's unique capabilities.

Throughout the series, we will make a few assumptions. First, we expect that you have some prior programming experience, typically in a language such as Basic or Pascal. Second, we assume that you have access to a copy of *The C Programming Language*, by Brian W. Kernighan and Dennis M. Ritchie. This book, often referred to as "Kernighan & Ritchie" or "K & R," is the definitive C reference manual. You will want to use it to get more detailed information on many of the topics we will cover. Finally, in each installment we will build upon information given in the previous ones. Each will contain a sample program. Because the way in which you use every C compiler is different, and because Lattice C (also shipped as Amiga C) was the first C compiler available for the Amiga, we have used it to test all of our program examples. (See the sidebar on Entering and Testing the Sample Programs, p. 51.)

History and Philosophy of C

The development of the C programming language began at Bell Laboratories in 1971 as part of the early work on the Unix operating system. It was originally written for the PDP-11 under Unix, but it was not tied to that architecture. C's predecessor, "B," owed a great deal to the language BCPL, which, coincidentally, was the language in which Tripos, the operating system ancestor of AmigaDOS, was written. The goal of the C developers was to construct a language that would be useful for systems programming on a number of different computer systems.

C allows the programmer to deal with the same basic constructs that the computer uses—characters, numbers and addresses. It also provides a framework of modern control flow mechanisms and data structures, a rich set of operators and a modular, function-oriented approach that encourages a building-block method of programming. It is a structured language, requiring predefined variables and providing constructs such as *while*, *if* and *for* statements that allow the programmer to avoid the use of *goto* statements. Yet, C is a small language that encourages economy of expression.

One reason that C can be small is that many capabilities (including math functions, I/O routines and basic operating system services) that are part of other languages are absent from C. Instead of being language constructs, they are provided as system library functions. Initially, these functions varied widely from system to system, but the pressures of application portability have led to a large set of standard C libraries.

Parts of a C Program

You construct a C program from a set of routines, some that you write and some that are supplied in system libraries. All C programs start at a routine that you write that must be called *main*. We will write only this one routine in our sample; in future installments, we will show programs composed of several routines.

A routine is represented by a name followed by its argument(s) in parentheses. This is followed by a block that is the body of the routine. A block of code is de- ►

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◄ limited by braces: { (open block) and } (close block). The name, arguments and block delimiters compose an empty routine. Make its name *main* and we have an empty program. The classic first program is little more than this. A standard C library function called *printf* writes information to the standard output (by default, your screen). Adding this function to our empty program, we get:

```
main( )
{
printf("Hello, world\n");
}
```

To write your first C program, type this into a file called helloworld.c and follow the instructions in the sidebar to compile, link and run it. Though this is a trivial program, we encourage you to use it to learn the program building procedures before moving on to more complex examples.

printf is shown here in its simplest form; it just prints the string you give it onto your screen. The *\n* is a special character meaning newline. This example also shows that all C statements must end with a semicolon.

Comments

In writing any kind of program, you should always include plenty of comments. In C, a comment is any text following the characters /* until the characters */ are encountered. Unlike some languages, the end of a line does not terminate a comment. So, be careful: Forgetting your */ can cause some of your code to be considered part of your comment.

Variables

All variables in C must be declared before they can be used. Declarations are put at the beginning of a block, before any other kinds of statements. When declaring a variable, you first specify its type. The two most common types are *int* (integer) and *char* (character). You follow the type with the name of the variable. All declaration statements are, of course, terminated by a semicolon.

Variable names must start with a letter and consist only of letters, numbers and underscores (_). Though variable names may be of any length, in most C versions only the first eight characters are significant. One peculiarity of C is that case is significant. Thus, the variable *i* is different from the variable *I*. Also, all C keywords must be in lowercase. We encourage you to avoid mixing cases and make all your variables either lowercase or uppercase, as distinctions based on case alone can easily become very confusing. Some valid sample variable names include: *temp*, *X2* and *myname*.

You can declare an array by following a variable name with the size of the intended array in brackets—[and]. You can also declare multiple variables of the same type by separating the names with commas. Here are some example declarations:

```
int total_errors;
int i, j, err;
char temp, name[ 80 ];
```

The first statement declares an integer variable, *total_errors*. The second declares three more: *i*, *j* and *err*. The third statement declares a character variable, *temp*, and an array of 80 characters, called *name*.

Basic Assignment Statements

Variables are given values and manipulated via assignment statements. The simplest example of this is the statement:

```
i = j;
```

This puts into *i* a copy of the value in *j*. More complex assignment statements involve expressions. Expressions can be arithmetic, using the operators + (add), – (subtract), * (multiply), / (divide) and % (modulus division). You can also have a unary minus. For example:

```
i = -j;
```

However, there is no unary plus. You also may include parentheses in your expressions as needed.

C supplies several shortcut constructs that you will encounter frequently, as many programmers find them useful. One class of shortcuts stems from the ability to have something called assignment operators. Such operators are used when the left-hand side of the assignment statement also occurs on the right. In this case, the operator is pulled to the left of the = and the duplicated term is dropped from the right-hand side. A few examples will help to clarify this construct:

```
i = i - 1;       is equivalent to   i - = 1;
j = j*(i + k);   is equivalent to   j* = i + k;
```

The other shortcut we should mention here involves the increment and decrement operators. A very common thing to do in a program is to add or subtract one from a variable. To increment a variable *i*, just do:

```
i++;    or    ++i;
```

To decrement it, use – – instead of ++. You need to be aware that there is a difference between the two forms shown. This difference matters when these constructs are in the middle of more complex statements. In the first form, *i* is incremented after its value has been used. In the second, it is incremented before its value is used.

Flow of Control

The way programs progress, by choosing what to do from among several choices, is often referred to as flow of control. In C, the basic components you will use to affect the flow of control are *if* statements, loops of various types and expressions.

The *if* statement consists of the keyword *if*, followed by an expression in parentheses, followed by the statement to execute if the expression evaluates to true. If you want to do something else when the expression is false, then this statement may be followed by the key-

word *else* and a statement to execute in that case. This example sets *j* to be *−i* if *i* is less than 0, or *j* to *i* if not (*j* will equal the absolute value of *i*).

```
if (i<0)
   j = -i;
else
   j = i;
```

C provides a full set of relational and logical operators that you can use in building such expressions. The following are the relational operators:

```
== (equal)
<  (less than)
>  (greater than)
<= (less than or equal)
>= (greater than or equal)
!= (not equal)
```

The logical operators are && (and), || (or) and ! (not).

You can create very complex expressions from these operators. When you do so, we suggest you use parentheses to specify precisely what you mean.

Relational and logical expressions evaluate to true or false. You can also put other types of expressions inside *if* statements and C will evaluate them. If the value of such an expression is 0, it is considered false; otherwise, it is considered true. Thus, you could put such expressions as *i−4* or *i=4* in *if* statements. The first is true unless *i* equals four, while the second is always true because it evaluates to four. An extension of this is that multiple assignments can be done as a single statement, such as:

```
j=i=4;
```

This leads us to a key point about C. Just about everything in C is an expression that can be evaluated to have some value. One type of expression often found in C that uses this feature is of the form *i=foo()*. In this example, *i* is set to the value returned from the function *foo*. The value of the expression is also this value. If, for example, *foo* returned a zero if successful, and some other value on failure, you could do the following:

```
if ( err=foo() )
   printf("error %d encountered\n",err);
```

In this statement, the function *foo* is called first. The value it returns is then assigned to the variable *err*. The expression is evaluated to be this same value. If the value is not zero, then the *printf* function is invoked and we get an error message.

This *printf* is a bit more complicated than the previous one. In the string to be printed, we placed the characters *%d*. They tell *printf* that the next argument after the string should be printed as a decimal number. For example, if *err* equalled 21, then on your screen would appear:

```
error 21 encountered
```

►

Listing 1. *Wordcount program.*

```
#include <stdio.h>    /* needed to define the constant EOF */

main()      /* count the characters, words, and lines in a text file */
{
   int c, num_chars, num_words, num_lines, in_a_word;

   in_a_word = 0;     /* start out not in a word, set true when enter one */
   num_chars = num_words = num_lines = 0;
   while ( ( c = getchar() ) != EOF )      /* read until the end of file */
   {
      num_chars++;
      if ( c == '\n' ) num_lines++;    /* hit a newline, got another line */

      /* We define a word as anything between spaces, tabs, newlines, or */
      /* any combination of these.  When hit one of these set the flag   */
      /* to show we're not in a word.                                     */

      if ( c == ' ' || c == '\n' || c == '\t' )
         in_a_word = 0;
      else

         /* Otherwise, if we weren't in a word, increment the word count */
         /* and set the flag to show we're now in a word                 */

         if ( in_a_word == 0 )
         {
            in_a_word = 1;
            num_words++;
         }
   }
   printf( "The file contains %d characters, %d words, and %d lines.\n",
           num_chars, num_words, num_lines );
}
```

◀ Conditionally executing only one statement is useful, but limited. The structured nature of C gives you greater power because you can use a block anywhere you can use a statement. A block consists of a group of statements enclosed in braces. Thus, you can do as much as you want as the result of either outcome of an *if* statement.

Loop Statements

The two other main conditional constructs are the *while* and *for* statements. *While* statements have basically the same syntax as *if* statements. The statement following the expression is executed until the expression evaluates to be false. If the expression is initially false, then the following statement is never executed. A common example of the *while* statement is the following:

```
while ( ( temp=getchar() ) != '\n' )
  name[ i++ ]=temp;
```

Here the character returned from the function *getchar* is placed in *temp*. We then check to see if it was a newline character. If not, then the contents of *temp* are put into element *i* of the character array *name*. The value of *i* is used before *i* is incremented, because the ++ operator is after the *i*. When a newline character is encountered, the loop stops.

The *for* statement looks a little different, but is based on the same primitives. This example sets the contents of the 80-character array *name* to be empty.

```
for ( i=0; i<80; i++ ) name[ i ]='\0';
```

The *for* statement has three components inside its parentheses. The first is the initialization statement. This statement is executed when the *for* statement is first executed. It is terminated with a semicolon. Here *i* is initialized to 0. The second part is the condition statement, which is also terminated with a semicolon. It is the condition to be checked before each time through the loop to see if we should continue or stop the loop. Here we want to execute the loop statement, *name*[*i*]= '*\0*'; so long as *i* is less than 80. The final part is executed at the "bottom" of the loop, after the loop statement and before we check the condition part again. Here we increment *i* to move on to the next array element.

Note that the first element in a C array is element 0. The array *name* has 80 elements that run from *name*[*0*] to *name*[*79*]. \0 is the C null character and is typically used to denote the end of a string.

Simple I/O

Although C has no built-in I/O facilities, nearly all C versions provide some way to open, close and manipulate data files. In fact, usually two different ways are available. In a later installment, we will cover how you can directly access files. However, we can get started by using another, simpler way, called stream I/O.

A stream treats a file as a sequence of bytes that you can read or write only in order. Streams can be just about anything that accesses bytes sequentially, such as input from a keyboard or output to a printer.

You can explicitly open and close streams, but there are three built-in streams that are automatically opened for your program when it starts and closed upon exiting it. These streams are referred to as standard input (stdin), standard output (stdout) and standard error (stderr). Assuming you start your program from the CLI, by default all of these refer to your current CLI window. To access all of these facilities from your program, you should have the following line at the start of the program:

```
#include <stdio.h>
```

We will discuss the *#include* construct further in a later installment.

The functions *printf* and *getchar* that we have mentioned previously use streams. They print to stdout and get a character from stdin, respectively.

Streams are particularly nice because you can redirect them from outside your program. Any program can get its input from stdin and send its output to stdout and not worry about files. Our example program does this. However, this does not mean that the program must read and write only using the current window. When you execute a program, you can redirect either stdin to be an input file or stdout to be an output file, or both. You do this by using a command line of the form:

```
program_name < input_file > output_file
```

By default, stdin consists of the characters you type, and stdout is the screen. When typing in the program's input, you tell it that you are done by typing CTRL \. The < character says to get input from the file *input_file*, while the > character says to write the output to the file *output_file*. Either or both may be used.

We now have enough pieces of C to put together simple programs. Our sample program is called *wordcount*. It is based on the Unix tool *wc*. It is a common introductory C program. In fact, a very similar version appears in K & R. We present it here because it illustrates a number of C constructs and has some real utility but is still fairly short. It counts the number of characters, words and lines in its input. It uses stdin and stdout for all its I/O, so you can run it on what you type or redirect it. We encourage you to use the instructions in the sidebar to enter, compile, link and execute *wordcount*.

In our next installment, we will discuss how to use multiple routines; we'll also cover slightly more complex areas of C. In the meantime, you might find it instructive and fun to try to write other simple programs. Remember to look into K & R for more information on the topics we've covered here. With just a little effort, you will find that C is a language that is both powerful and pleasant to use for your programming tasks.■

Address all author correspondence to Mark L. Van Name and William B. Catchings, 10024 Sycamore Road, Durham, NC 27703.

Entering and Testing the Sample Programs

Lattice C makes the process of getting your programs ready to run reasonably simple and painless, although you do need to follow the instructions here fairly carefully to avoid any unpleasantness. We assume that you have two disk drives on your system. (If you do not, refer to the Lattice C manual for instructions on how to set up your development disk. Once it is ready, the rest of the instructions should be the same.)

The first thing to do is to prepare two disks. The first is called C-CLI. It is a bootable disk that will hold some of the compiler commands and the CLI (in which you will come up when you boot this disk). The other is the disk on which you will work; it is called C-DEVEL. To build these, follow the instructions in Appendix D of the rev. 1.1 Lattice (or Amiga) C manual. Follow it up to the section labeled "II".

Once you have done this, your two disks are nearly ready to go. Put the C-CLI disk in DF0: and the C-DEVEL one in DF1:, then reboot. Next, from the CLI in which you will find yourself, type:

```
copy DF1:examples/make#? DF0:s
```

You will see the following messages:

```
DF1:examples/make..copied
DF1:examples/makesimple..copied
```

Now your disks are ready for you to begin entering our example. Move to the development disk (C-DEVEL) by typing:

```
cd DF1:
```

Make a directory in which to put this and the other samples we will give you and then move into that directory by typing:

```
makedir C_tutorial_programs
cd C_tutorial_programs
```

Now you are ready to type in the program. If you want to use the ED screen editor, enter:

```
ed wordcount.c
```

to create the file *wordcount.c* and start work on it. Feel free to use any other text editor you want, but create an ASCII file (beware of the oddly formatted files created by many word processors) named *wordcount.c* and enter the text of the program.

Once you are done and have checked it for typing errors, you are ready to compile and link the program. Enter:

```
execute makesimple wordcount
```

Note that you omit the *.c* suffix from the file name, since the *makesimple* command assumes it. Having your source files end in *.c* is a very common C programming practice.

You will see a lot of messages very similar to the ones shown in section II.3 of Appendix D of the rev. 1.1 Lattice C manual, except that the file name and size will be different. You will see the CLI prompt when this is all done. The process will take several minutes, so be prepared to wait a bit.

When you are back in the CLI, you are ready to run the program. The linker named the program *wordcount* by default. As an example, if you want to run it on the source file *wordcount.c*, just enter:

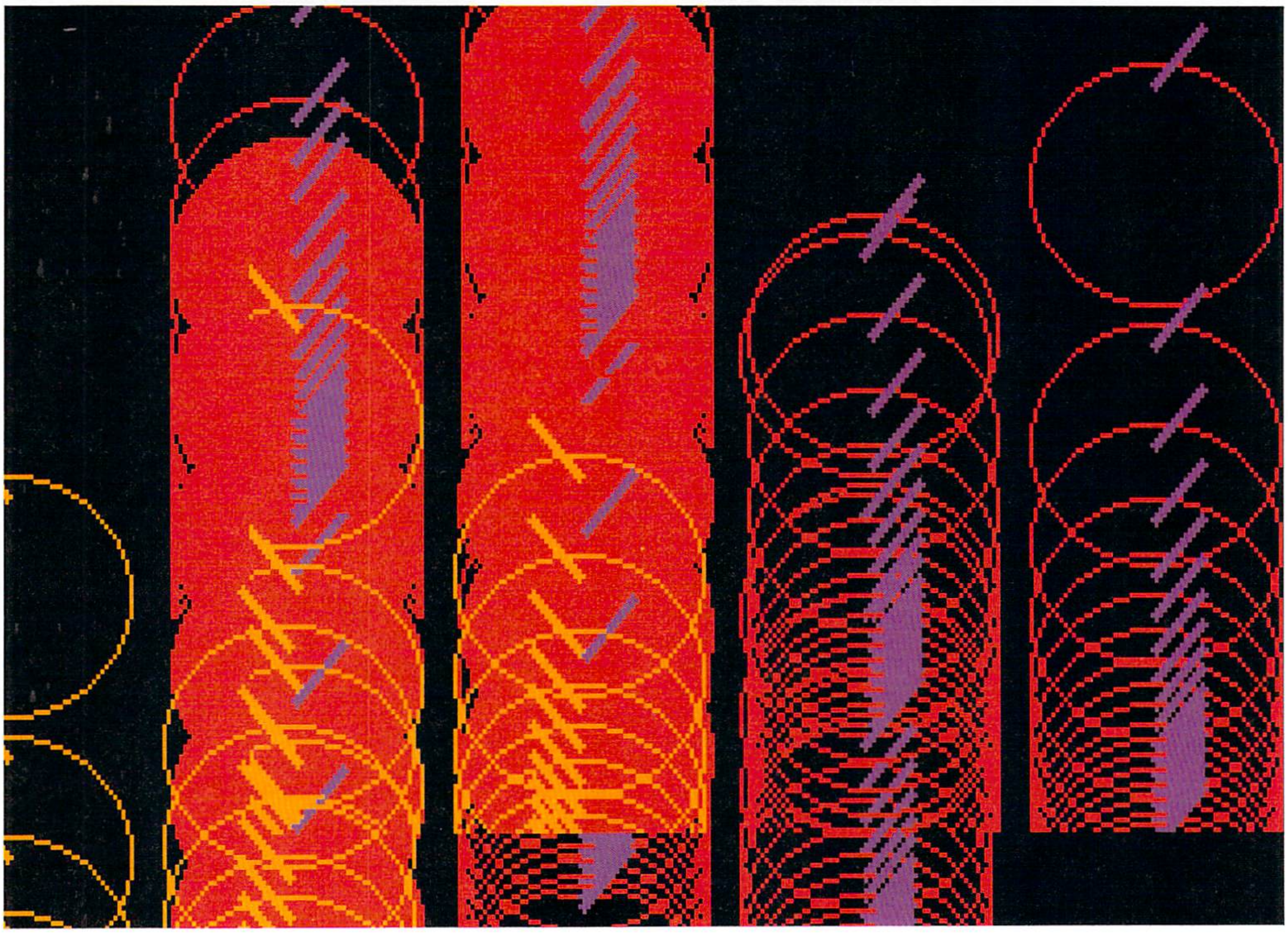
```
wordcount < wordcount.c
```

This will print the output to the screen. You can also redirect the output or cause the program to count what you type. If you do the latter, enter CTRL \ when you are done with the input.■

The Apple Connection

By Andrew L. Hollander

Transfer your old Apple II files to the Amiga through the RS-232 connection and this file-transfer utility program.



The Amiga is, in many respects, the computer I have dreamed of for years. But the hardware is only half the story. As most of you know, Amiga software is still largely unavailable. There are several ways around this problem. First, you can shell out $500 for the Transformer and the 5 1/4" disk drive to read IBM format disks. But then you'll be stuck with running IBM compatible software, and losing out on a number of the advantages of using the Amiga operating system. If that was all you wanted, you should have bought an IBM PC or a PC clone for less cash outlay than buying the Amiga and the needed extras. Also, your files might not be on an IBM or compatible machine; mine are on an old Apple II+.

The second alternative is to "launder" your files over the phone lines. Many computerists will recognize what this means without reading further, but for the newer crowd, I'll explain. It is possible to transmit programs and information over the telephone by way of a modem. All a modem does is MOdulate outgoing data into sound pulses that can be carried over phone lines, and DEModulate the incoming sounds, turning them into machine-interpretable codes.

This is a great idea, and if you have purchased a modem and a smart-terminal program for your Amiga, this is one way that you can funnel the world of information into your computer. However, this only works when the two computers that are to communicate with each other have access to separate phone lines. If the two computers reside side by side, like mine, then such transfers become very tricky. If I had a modem for both machines, I could upload files to a third computer over the phone, then download to the Amiga, but two transfers become time consuming at 300 baud (bits per second) over the phone lines. This can also become expensive if you must pay for the time that you are connected to the third computer. Anyway, I do have a Hayes MicroModem II that slips into a peripheral slot on the Apple, but I still do not have a modem or a smart-terminal program for the Amiga. These are only minor deterrents, though.

The RS-232 Connection

There is still another method to directly transfer information from the Apple to the Amiga. The Amiga's RS-232 port can be connected directly to other types of equipment, such as modems, printers, etc. (I added a similar port to the Apple several years ago to handle a letter-quality printer.)

The RS-232 connection is actually a very natural way for a computer to receive information, as it is typically the port into which an external modem can be plugged. Since the two machines are side by side on my table, there is no distance problem to contend with, and for capturing files on the Amiga, one of the sample programs on the Extras disk with Amiga Basic does half the programming work.

So, there are two separate aspects of this project: First, the hardware aspect, which requires building or buying a cable to connect the two machines; and second, the software aspect, which requires a program for saving the files on the Amiga when sent from the Apple.

Software for the Apple will not be considered here since, firstly, the programs will be different for every machine, and secondly, it is a relatively trivial problem. On nearly any machine, direct the program to make the RS-232 port the printer output port. The transfer of information is strictly a one-way affair. The host computer does not have to know that there is anything but a printer on the RS-232 port, while the Amiga will happily absorb information and save it. So, you can use word processors or other programs that send data to the printer on the host computer.

Hardware Description

The RS-232 port on the back of the Amiga is a standard female DB-25 connector. This is the most common connector for RS-232 connections, even though one can get away with a non-standard DB-9 connector as Apple did with the Macintosh. The Amiga's port is configured ►

to connect directly to an external modem with the standard (if there really is such a thing) connections on pins 1 through 8 and 20. There is a recognized standard for RS-232 connections, but unfortunately, not everyone subscribes to it. So, look closely at the technical information that comes with the device you plan to connect to the Amiga.

Using care in making connections with the Amiga RS-232 port is particularly important. There are several other pins in the Amiga's otherwise standard interface that are unusual (see Table 1). For interfacing most equipment, pins 1 through 8 and pin 20 are the only ones needed for data transmission. In this particular case, I strongly recommend against using a ribbon cable type connection between the Amiga and any other type of equipment. Ribbon cables are easy to put together, but they have several drawbacks. They are more prone to damage because of their exposed nature. These cables are not as well shielded against electrical interference. And, they directly connect all 25 pins. Unless the instructions specifically state that the pinouts are 100% compatible with the Amiga configuration, wire *only* those pins that are needed. This is important because pin numbers 14, 21 and, in particular, 23 are for powering accessory equipment. For equipment designed to draw power from the host computer, this is fine, but many types of equipment are not. So, connecting directly to pins 14, 21 or 23 could result in a damaged peripheral or even a damaged computer.

Pin #	Abbreviation	Description
1*	GND	Frame Ground
2*	TXD	Transmit Data
3*	RXD	Receive Data
4*	RTS	Request to Send
5*	CTS	Clear to Send
6*	DSR	Data Set Ready
7*	GND	System Ground
8*	CD	Carrier Detect
14	−5v	−5 Volt Power Connection
15	Aud0	Audio Out of Amiga
16	Aud1	Audio Into Amiga
17	EB	Buffered Port Clock
18	INT2	Interrupt Line to Amiga
20*	DTR	Data Terminal Ready
21	+5v	+5 Volt Power Connection
23	+12v	+12 Volt Power Connection
24	RESB	Buffered System Reset

*Typical connections for standard RS-232 to modem.

***Table 1.** RS-232 pinouts for the Amiga modem serial port.*

If you intend to buy a cable, I recommend a standard shielded RS-232 cable with only pins 1 through 8 and 20 connected. This avoids any possibility of equipment

coming into contact with the power lines. If you are building your own cable, use an ohm meter to make certain that your connections are correct.

Here's another problem that you might run into. When looking at the information on the pinouts of the Apple, I found that pins 1 through 8 and 20 are all designated the same as on the Amiga. This is fine except for pins 2 and 3. The pins that transmit data (TXD) must be hooked to the pins that receive data (RXD) on the other machine. So, when making the cable, pins 2 and 3 from the Amiga connect to pins 3 and 2 of the Apple, respectively. Such a cable, with pins 2 and 3 crossed, is called a modem excluder.

The cable, in many cases, may be much less complicated. In fact, some printers only need connections on pins 1 (GND), 2 (TXD) and 7 (GND) of the Amiga. The connection with the Apple is just as simple, since the Amiga looks like a simple printer to the Apple. So, only pins 1 (GND), 3 (RXD) and 7 (GND) on the Amiga are linked to pins 1 (GND), 2 (TXD) and 7 (GND) of the Apple. Remember, though, that this cable is for simple one-way communications. If you want two-way interaction between machines, the hardware handshaking lines (Pins 4 (RTS), 5 (CTS), 6 (DSR), 8 (CD) and 20 (DTR)) must be dealt with.

Software

Once the two machines are connected, there must be a way to capture and save the information coming to the Amiga in a usable text file. This allows you to access this information with word processors and other programs. This information may also be source code for new programs on the Amiga that may have been favorites on other machines.

Here's the design criteria for the Capture program that I've written for capturing transferred information:

1. Information from the RS-232 port is saved to a disk file.
2. The user is prompted to enter the disk file name for storage.
3. Multiple files can be stored during a single session.
4. Keyboard input during a capture does not interfere. Menu selection is needed to terminate a capture.
5. Information being captured is also displayed on the monitor.

The next step in the programming process is to develop flowcharts for the program using the design criteria. The design of the Capture program is fairly simple (see Figure 1).

The third step is to begin the actual writing of the program. Some programmers write pseudo-code for their program first, but I find that I compose just as well on an editor, and substantially faster, so long as I stick with the design. Since I was relatively unfamiliar with Amiga Basic, I added another step to this process. I wrote and played with a number of test programs to make sure that everything worked the way I thought it should. ►

Listing 1. Capture program.

```
REM Program "Capture"
REM in Amiga BASIC (by Microsoft)
REM by Andrew L. Hollander
REM 23 January 1986

REM This program takes data coming from the Amiga modem port,
REM displays the information on the screen and saves it to a
REM disk file.

REM Open output window with name "Capture" and make it the
REM default I/O window so the user does not have to click the
REM mouse in the window before it is usable.

  WINDOW 1, "Capture"
  WINDOW OUTPUT 1

REM Menu setup.  Adds a category to the main menu selections
REM with one option for closing the input file.

  MENU 5,0,1, "Terminal Close"
  MENU 5,1,1, "Close"
  MENU ON
  ON MENU GOSUB Finish

REM Get file name and open disk file for output.

  GOSUB FileNaming

REM Initialize RS-232 communications port.

  OPEN "com1:300,N,7,2" AS 1

REM Infinite terminal loop.  May only be exited by using the
REM menu selections.

TerminalLoop:
  WHILE 1
    WHILE LOC(1)<>0
      I$ = INPUT$(1,1)
      PRINT (I$);
      PRINT#2, I$;
    WEND
    I$ = INKEY$
  WEND

FileNaming:
  REM Opens the RS-232 port, asks for File name to save to
  REM and opens the file for output.

  CLS
  PRINT "                    File Capture Utility"
  PRINT "                    by Andrew L. Hollander"
  PRINT "                    23 January 1986"
  PRINT
  INPUT "Type in name of file to be saved to:  ", Filename$
  OPEN Filename$ FOR OUTPUT AS 2
  RETURN

Finish:
  REM Closes all, loops back if another file is to be passed
  REM or ends the program if not.

  CLOSE 2
  PRINT
  INPUT "Do you wish to save another file? (Y/N)  ", I$
  IF (I$ = "Y") OR (I$ = "y") THEN
    GOSUB FileNaming
    RETURN
  END IF
  MENU OFF
END
```

◄ I began with a sample program provided with Amiga Basic, called Terminal. This is a very simple program that performs a non-trivial task. Terminal takes characters coming in from the RS-232 port and displays them on the screen, and sends characters from the keyboard out to the connected device through the RS-232. There is no echoing of the keyboard to the screen, or anything fancy, like file captures. Even so, Terminal is a powerful beginning for those interested in writing a smart-terminal program.

While working with this program and a hardware connection to a terminal, a problem appeared. (Most people would never tell this story for fear of revealing their ignorance, as I am about to do, but at least you can learn from my mistake.) I went through the standard debugging routine. The program was running, I had OPENed the COM port properly and to the correct baud rate (bits per second), and I was getting the correct characters from the terminal written to the Amiga screen. What I did not get was characters transferred from the Amiga keyboard to the terminal. So, I started writing simple test programs to see where the problem was.

I found two commands that did not appear to work as documented. The first was the Inkey$ statement, which checks for character input from the keyboard. If there is no input from the keyboard, Inkey$ returns a null string (string with no characters in it). If there is input at the keyboard, the character waiting in the keyboard buffer is returned. This tends to be a rather important function in the program Terminal. Without Inkey$, no characters are collected from the keyboard to be output to the device connected to the Amiga. When I pressed any key on the Amiga keyboard, the screen flashed at me, but the typed characters were nowhere to be seen.

Since I was not interested in sending information from the Amiga keyboard to the Apple, Inkey$ was not absolutely necessary for the implementation of a file-transfer program. However, I did want the ability to type in the name of the file in which to store the incoming information. This should be simple enough, I thought. The procedure would be simply to use a statement such as this:

```
INPUT "Type in name of file to be saved: ", FileName$
```

where FileName$ is the name of the disk file to be saved. Then I would proceed to open FileName$ as my sequential output file. It sounds simple, but there was a problem. It appeared from the way this line failed to work that the Input command relied on the same character input handling routine as Inkey$, thus rendering them both inoperative. But these statements actually do work. After several phone calls and a visit to my dealer, the problem was solved. If I want keyboard input to the window, I need to place the pointer inside the window and click the left mouse button once. My mistake had been in assuming that the window in front would auto-

matically be the default output window. There is a way to assign the window for output from within the program. My solution involves the Window command as follows:

```
WINDOW 1, "Capture"
WINDOW OUTPUT 1
```

The first line renames window #1, which is the normal output window for Amiga Basic. The first line is not a necessary one, but handy for knowing if the program is still running. The quoted name will appear in the upper left-hand corner of the window's banner. The second line designates window #1 as the default output window when the program is run.

Ready to Run

Once the connection is made and the Capture program (see Listing 1) is entered and saved, you are ready to run. The program will ask for a file name in which to save the information. After you enter the name and press the return key, there will be brief disk drive access to open the new file. Now the program is ready to accept information from the other computer. Simply have the other computer send the information to the RS-232 port as if it were a printer. The Capture window will show exactly what is going into the disk file from the source computer.

Once all the information you want is passed, there must be a way to close the file and terminate the program gracefully. The menu selection Capture Close accomplishes this task. The menu bar is accessed by pressing the right-mouse button. Place the pointer over Capture Close; select Close, which is the only item in this menu. This will close the disk file. The program will prompt for restarting the process or ending the program. By typing anything other than Y or y, the program ends, placing you back in Basic command mode operation. Otherwise, the process is repeated from the prompt for a file name. Unless you want a file to be overwritten, use a different file name. There are no safeguards built into this program to prevent you from writing over existing files.

Modifications

In the Capture program, I tried to avoid ambiguity through the use of documentation. You might already be thinking of ways to improve the program. There are several modifications I have considered to make it more user friendly and useful. One useful function would be for the program to check for a file name on disk matching the one about to be opened. If there is one, the program should ask if you wish to overwrite the existing file or use a new file name. Another nice addition would be for the incoming information to be stored in a buffer and have the program check to see if enough space is left on the disk for the file.

Trying to get two micros to talk to each other can be quite a challenge, but it's worth the effort. I hope that the Capture program and my suggestions will help to take some of the frustration out of making your own RS-232 connection.■

Address all author correspondence to Andrew L. Hollander, 51403 US 31 North, South Bend, IN 46637.

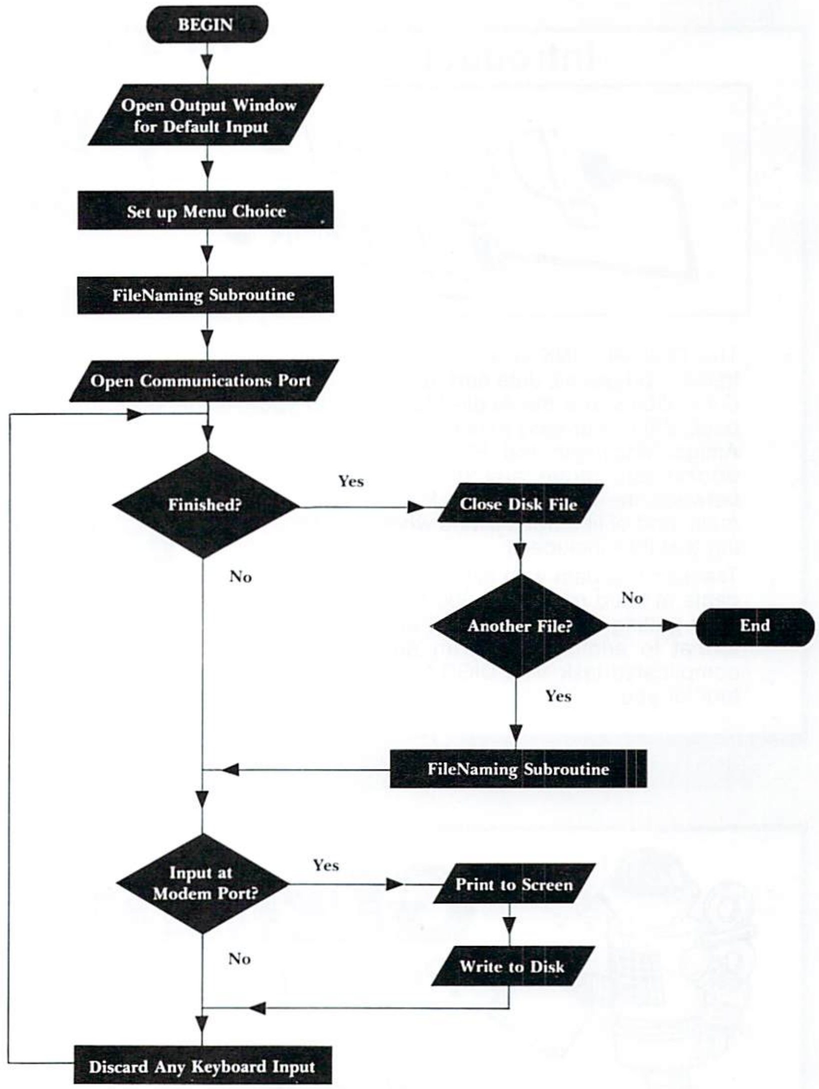


***Figure 1.** Flowchart for Capture program.*

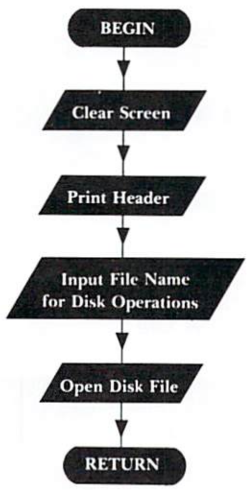


***Figure 2.** Flowchart for FileNaming subroutine.*

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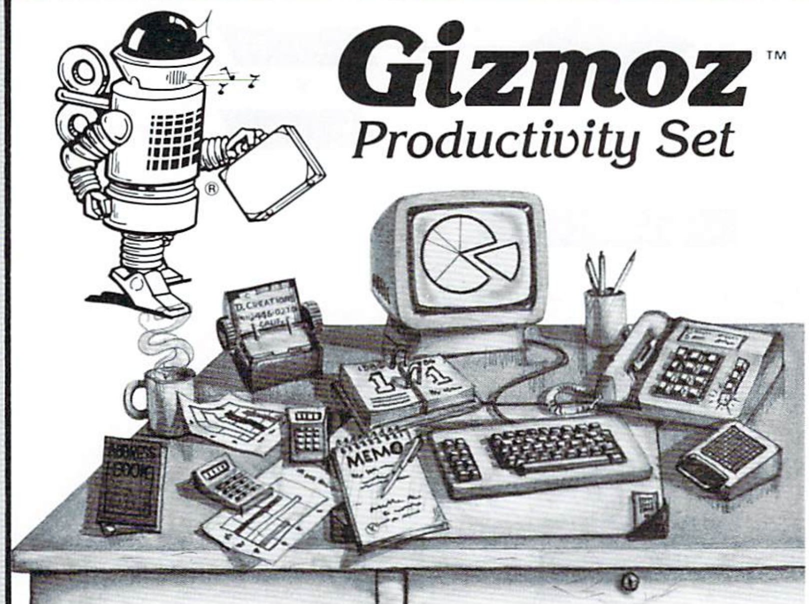
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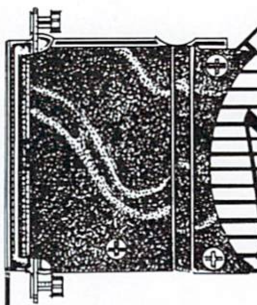
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Making Backups

The Amiga makes its usage as intuitive as possible. But, like any computer, the Amiga is so complex that you often need additional information to get the most from it. In this column, we will address real problems you may encounter. At the same time, we will help the more advanced among you to explore some of the Amiga's unique features. This two-pronged approach will allow you to get the most out of your machine.

By Mark L. Van Name and William B. Catchings

One of the first things you are told to do by the manuals for almost all software products is to make a backup copy of the software. To do this, you must copy all of the information on the disk you bought onto another disk. While making such backups, as well as backup copies of your work, is definitely a good practice, you are rarely told how to do so.

Choose Your Style

Your Amiga system offers you several different ways to make these disk copies. These differ in the number of disk drives they require and in the style you use. Whether you have one disk drive or two, and whether you prefer to use the mouse or to type in commands, there is a method for you. We present several below. Pick the one that will work on your system and feel most "natural" to you.

For all of these methods, your Amiga must have been started up using a Workbench disk. The destination disk, the one to which you are copying, must be "write-enabled" (i.e., the little square hole in the right-hand corner must be covered). Since disk swaps do not check for the correct disk, we recommend that you "write-protect" the source disk (i.e., make sure you can see through the hole). This prevents the source disk from accidentally being ruined. Also, be aware that disk copying will overwrite the old contents of the destination disk.

For Two Drives

If you have two disk drives, the simplest way to make a backup copy of a disk is to use an "icon-based" method. Put the source and destination disks into different disk drives. (If the destination disk is unformatted, its icon will be labeled something like DF1:BAD. This is normal; don't worry about it.) Move the cursor on top of the source disk's icon and press the left button on the mouse. Without releasing the button, drag the resulting little orange marker over the destination disk's icon. Then release the button. A requester box will appear and ask you to put the disks in the proper drives. Your disks should be in the drives indicated. If they are, move the cursor onto the Continue icon in the requester box and click the left button. If they are not, arrange the disks before continuing, or cancel the disk copy by moving the cursor to the Cancel box and press the left button. When the



copying is done, the resulting destination disk will be named "copy of <src>" (where <src> is the name of the source disk).

For Single Drives

Unfortunately, there is no corresponding way to copy disks by icon dragging if you have only one disk drive. Instead, you can use the following method. Though it will work on a two-drive system as well, it uses only one drive and is consequently slower than the icon-based method. First, click on the icon of the disk you wish to copy. Then, press the right button on the mouse and hold it down. Point to the menu title "Workbench" in the top line of the screen, and then to the Duplicate choice that will appear beneath it. Release the button. You will be prompted as before either to cancel or to continue. Assuming you choose to continue, you will be asked to insert the source and destination disks alternately into your disk drive. Do so, then move the cursor to Continue and click the left button after each disk swap. You will have to do this several times (three disk swaps on a 512K Amiga). Remember, don't touch the disk drive while the red light is on!

Using the CLI

The final way to make a backup disk is useful if you use the AmigaDOS CLI (Command Line Interpreter). Start it up and at the prompt (usually "1>") type:

```
DISKCOPY FROM <src> TO <dest>
```

where <src> and <dest> are the names of different disk drives such as DF0: and DF1:. Insert the disks as requested and then hit return. If you only have one disk drive, issue the command as above, but make both <src> and <dest> DF0:. Swap disks and click on Continue as needed.

The Assign Command

When you are finished making your backup disks, you might want to linger for a minute in the CLI, for serendipity can be yours just for the cost of a little time spent playing with the AmigaDOS commands.

Consider, for example, the Assign command. Basically, this command allows you to create aliases for your directories and files. These aliases are called "logical devices." You can use logical devices to reference a file with a simple name, regardless of where it is stored. Thus, if you have a program that starts out in one directory but that might later move, you could give it an alias as follows:

```
ASSIGN fred: :directory1/myfile
```

You just refer to it as fred: in all your normal commands. Then, if you move it to a directory, "directory2," enter:

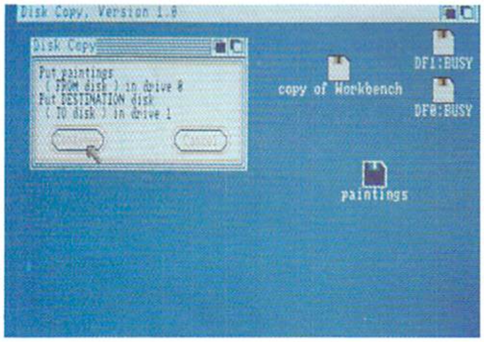
```
ASSIGN fred: :directory2/myfile
```

and the name fred: will keep on working. All logical-device names must end in a colon.

Using Assign becomes more interesting when you realize how much typing effort it can save you. You can use it to avoid entering the entire pathname for each of your files, as in the following:

```
ASSIGN source: DF0:work/myproject.c
ASSIGN object: DF0:work/myproject.o
ed source:
tlc source:
EXECUTE object:
```

Assign becomes still more valuable when you realize that all of the AmigaDOS com- ►



Workbench screen during two-drive disk copy.

mands are just files on the Workbench disk—files to which you can give new names! You can customize your own CLI. For example, let's say you prefer to use the command Look to display the contents of your files rather than the Type command. Enter:

ASSIGN look: c:type

Then, given the earlier Assigns, you can view your program source by typing:

look: source:

It is important to keep in mind that any Assigns you do will last until you either turn off or reboot your Amiga. However, you can undo the effect of any Assign just by entering:

ASSIGN <name>

where <name> is the logical device you wish to remove. Even so, you should take care with the names you give. C:, as you can see from the above example, is used by the CLI to find its commands. If you assign C: to be a command abbreviation (e.g., for CD), you will have difficulty accessing your CLI commands. Finally, if you get confused about exactly what logical devices you have, just type Assign and the Amiga will show you.

As friendly as it is, even the Amiga does not always tell you about all the possible sources of frustration and fun. A little experimentation, along with the knowledge you glean from here and elsewhere, should help you get the most fun and the least frustration from your Amiga.■

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Giving Your Mouse a Rest

Most of the methods for using the Amiga discussed in this column and elsewhere are explained in terms pertaining to the use of the Amiga mouse. However, the mouse is not always for everyone. If you are a touch-typist, maybe you are getting tired of taking your fingers off the home keys in order to use your mouse. Or, perhaps your desk is not quite yet a part of the "paperless office" and you just do not have enough space for your mouse to roam. Fortunately, unlike some icon-based systems, the Amiga lets you have your mouse and leave it, too.

There are three things you can do with your mouse: point, press the left button and press the right button. The results of each of these actions can be accomplished with the keyboard as well.

You can move the pointer just by holding down either of the two Amiga keys while also pressing any of the four cursor (arrow) keys. The Amiga keys are on either side of the space bar and are marked with the capital letter "A." The longer you hold down an arrow key, the faster the pointer will move in that direction. To make the pointer move faster still, you can also hold down either shift key along with the Amiga key and an arrow key. When the pointer has reached its goal, you should release the arrow key.

Once the pointer is positioned correctly, you often will want to use one of the mouse buttons. You can get the same effect as pressing the left (select) mouse buton by pressing both the left Amiga key and the left ALT key. Similarly, you can simulate the right (menu) mouse button by pressing both the right Amiga key and the right ALT key.

For example, let's say you wanted to open the Workbench icon without ever lifting your hands from the keyboard. You could do so by first holding down either of the Amiga keys and the appropriate arrow keys to move the pointer over the Workbench icon. Then you could select that icon by pressing the left Amiga and the left ALT keys simultaneously. To pick the Duplicate option from the Workbench menu, you would hold down the right Amiga and ALT keys while pressing the appropriate arrow keys to highlight Duplicate. Then release all of the keys to choose that option. With a little practice, this can become almost as easy as using the mouse.

These techniques may seem only to contort your fingers and to remove some of the ease-of-use advantages of the icon-based Amiga. If so, stick to the mouse. However, if you prefer to keep your hands always on the keyboard, or if your mouse ever gets buried under the paperwork, it is nice to know that you can still use your Amiga.■

Stopping the World from Passing You By

Sometimes in the CLI, the world may seem to scroll by far faster than you can follow. This can happen when you type a large file or do a Dir command on a directory with a lot of files. Given the small size of the initial CLI window, it can even happen when you try to list all of the default system Assigns.

This problem obviously is not unique to the Amiga. Many systems allow you to start and stop the scrolling of text with a scroll-lock key or by typing one character to stop and another to restart scrolling. These characters typically are Control-S and Control-Q, respectively. Typing such unusual key combinations can be troublesome.

The Amiga simplifies this problem. If you want to stop text from scrolling by, just hit any key. To restart the text, hit any other key. Nothing could be simpler.

Well, almost nothing. There is one slight problem. The Amiga remembers the keys you type and uses them as the first characters on the next command line when all of the text from the last command has gone by. This means you should choose your scrolling start and stop characters carefully. One good choice is the space bar (or any letter or number) to stop scrolling and the backspace key to restart it. By using these two characters, every stop-scrolling character will be deleted by the corresponding start-scrolling character, and you will not end up with any extra characters on your next command line.■

Amiga Kermit

By David T. McClellan

This issue we explain how to use the terminal-emulation program Kermit with your Amiga, so you can get your mits on all that good stuff out there in the land of Public Domain. We've also included some vital information on where to look for it once you know how to get it.

In my last article I briefly discussed how public domain software came about. Now I'll tell you where and how to get or donate such software. Where to find public domain software is discussed in the accompanying sidebar on Bulletin Board Systems and Other Sources; in this article, I will tell you how you can take advantage of these sources through a terminal-emulation program with file-transfer capability: Columbia University's Kermit protocol.

History of Kermit

The earliest method of sharing information between computers (and one which is still in frequent use) was to dump the data onto cards or tape and entrust it to the post office. This was slow, and if any data was lost, all of it was. Later, someone got the bright idea of using communications lines—leased and standard telephone—to let computers transfer data. Mainframe manufacturers evolved various data-transfer protocols, none of which became established in the industry as a standard. Each used their own proprietary format.

In the late 1970s, when many hobbyists had both micros and the desire to share programs, Ward Christensen and others designed the Xmodem file-transfer protocol as part of the Modem program for CP/M. It worked fine across small systems, but there was no single guiding force promulgating Xmodem across all systems as a standard protocol, and it had certain restrictions that could not be obeyed by all types of computers.

In the early 1980s, Frank da Cruz and Bill Catchings of Columbia University designed the Kermit file-transfer protocol with the express idea of having a standard protocol available both on the DEC and IBM mainframes at Columbia University, and on the microsystems that were beginning to flood the campus. Their original purpose was to ease some of the file storage problems on the mainframes, off-loading the burden to floppy disks owned by students and professors. The project grew into a center devoted to getting Kermit supported on every computer possible, so that any two machines could swap data at need, whether they used seven- or eight-bit data paths, half or full duplex, or any other vagaries of serial communications.

Daphne Tzoar and Bill Schilit, also of Columbia, and numerous people at other sites around the country, aided them in writing the first programs that supported Kermit. It soon ran on mainframes such as the IBM VM/CMS and DEC's TOPS-20, minis running Unix and other operating systems, and micros such as IBM PCs, Commodore 64s and Apple Macintoshes. They have succeeded in their goal to such an extent that Kermit file transfer is now available in almost 200 implementations, on thousands of computers worldwide.

Rather than putting Kermit directly into the public domain, Columbia University copyrighted Kermit, to prevent it from being taken by a third party and sold as a product. They then allowed all the Kermit software to be distributed free of charge, allowing anyone to modify an existing Kermit and port it to a new machine (which I have done to bring up Amiga Kermit). This brings it into the category of software I can write about: good *free* stuff. As of early 1985 it was available in source form on Compuserve, USENET (via Oklahoma ►

Continued on p. 70

Bulletin Board Systems And Other Sources

Bulletin Board Systems (BBSes) are computers set up as dial-in servers, with free (or cheap) access by private citizens, computer stores and sometimes large companies. They provide facilities for posting messages and notices, and file upload and download for dial-in users.

The earliest BBSes were privately owned, floppy-based microcomputers that were used as phone-in bulletin boards, designed for leaving private and public messages for other programmers. People started posting useful programs on them as well as notices, and they evolved into sources for public domain software.

Most BBSes nowadays have Kermit and/or Xmodem protocol support for downloading and uploading software and data, and have fair-sized hard disks. They also still allow you to post notices. One BBS network I know of, Fidonet, is made up of a large number of privately owned computers all running the Fido BBS software (Fido nodes). Besides message posting and software, for a small charge, Fidonet provides a coast-to-coast electronic mail service. Fidonet computers automatically dial each other up at night to forward mail across the country. One of the BBSes below, Casa Mi Amiga, handles Fidonet mail.

Another source of public domain software is user's groups, some of which are just getting set up for Amiga users. These are groups that meet on a regular basis to exchange ideas and software. Several provide catalogs of disks of software, available for a nominal fee (the cost of the disk and copying wear-and-tear). Private individuals also sometimes perform this cataloging and copying service.

Software Availability

Amiga Kermit will shortly be available on disk from my local user's group (AURA, listed below). Other AURA disks are currently available for $5 apiece. Write to Ray Cook at AURA for a current list of software. I will try to make everything I review available through them. As for other Kermits, the Columbia University Center for Computing Activities tries to coordinate distribution of Kermit programs, so they have the best information on how and where to get Kermit for a given machine. They can also provide a full set of documentation for a fee.

The game I reviewed in my last article—Hack—is available from another local programmer who finished porting it before I did, freeing me for other work. His name is John Toebes, and he will supply a floppy disk containing Hack for $6.00 (disk and postage costs). Write to John Toebes, 120-H Northington Place, Cary, NC 27511.

Below are listed some bulletin board systems with Amiga sections, some user's groups and a few other related sources.

BBS Systems

Casa Mi Amiga
(24-hour, 16-meg. hard disk)
904/733-4515

Micro Systems Software
305/737-1590

Amiga Developers Exchange
408/372-1722

User's Groups

Boston Computer Society (BCS)
Amiga SIG (Special Interest Group)
617/263-8070

Jersey Amiga User's Group (JAUG)
Contact: Perry Kivolovitz
201/271-4522

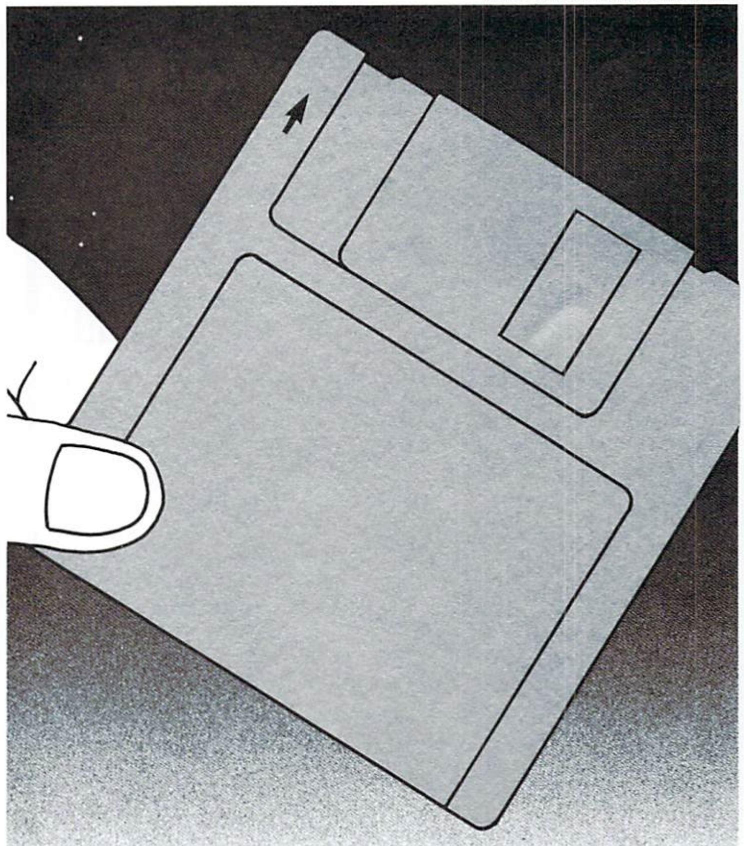
North American Amiga User's Group
Contact: Richard Shumaker
Box 376
Le Mond, PA 16851

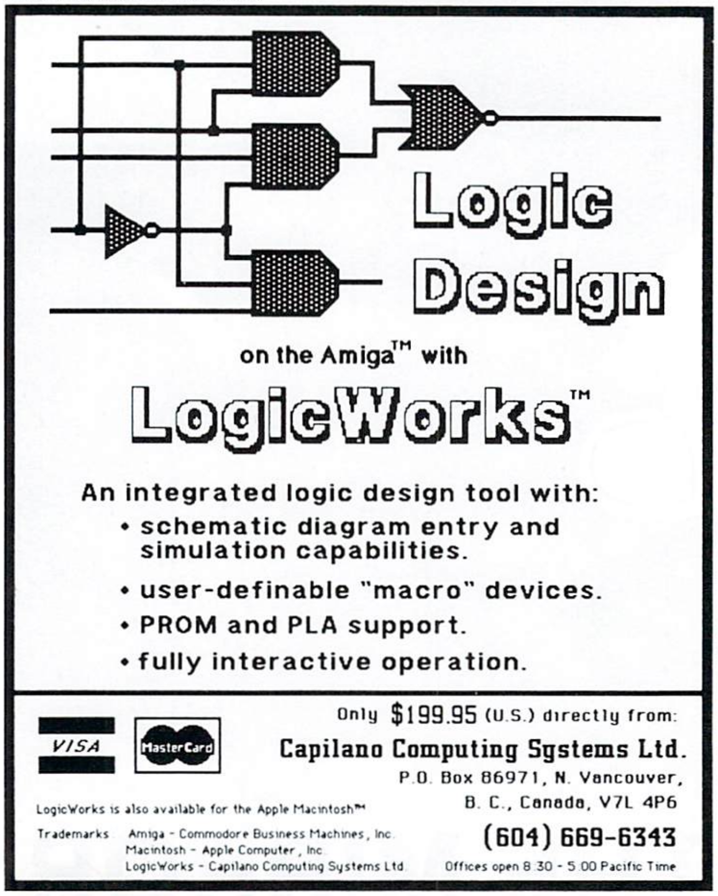
Amiga Users—Raleigh Area (AURA)
Contact: Ray Cook
1114 Wildwood Road
Durham, NC 27704

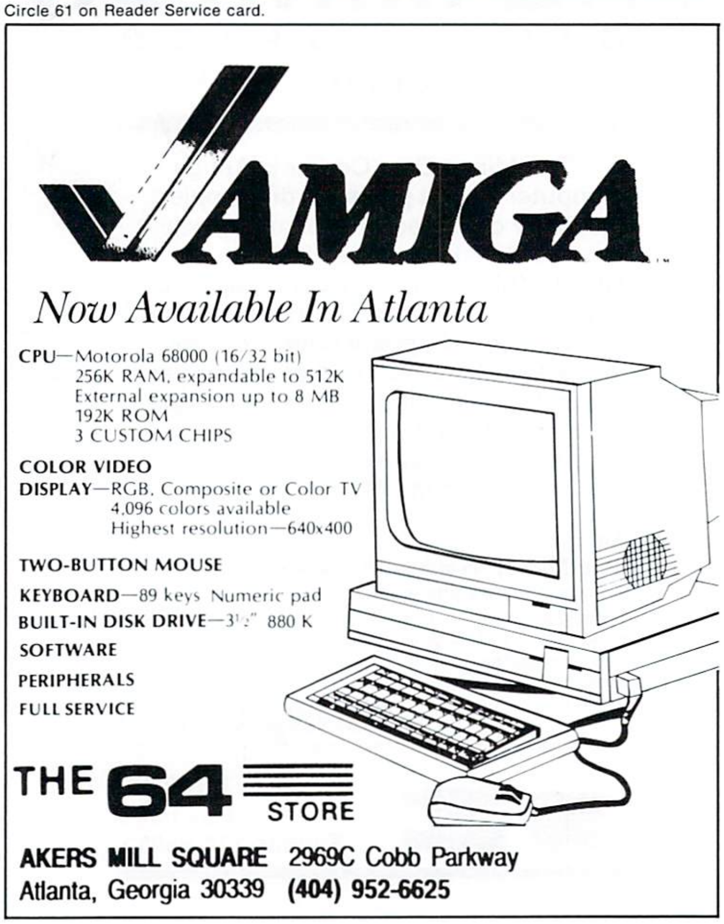
Other Sources

Kinetic Designs (owners of Casa Mi Amiga)
Casa Mi Amiga
1187 Dunbar Court
Orange Park, FL 32073
(Send self-addressed stamped envelope for list.)

Maple's Freeware Directory
Box 23, Station M
Calgary, Alberta
T2P 2G9 Canada
(Currently compiling a catalog of freeware/shareware.)







◄ *From p. 66*

State), on the government's ARPANET, and was being distributed by many large and small user's groups. See my sidebar for more information on obtaining Kermit and other public domain software.

The version of Kermit I have converted is C-Kermit, a well-modularized version the Columbia folks wrote in C with the idea of making the program itself as portable as possible. MacKermit (Macintosh Kermit) is also based on C-Kermit, and I will borrow heavily from its pull-down menu method of operation to finish the next version of Amiga Kermit, integrating it with Intuition's high-level user interfaces. More on that later.

Using Kermit

A generic Kermit program has three distinct modes as perceived by the user: terminal emulation, file transfer and a command interpreter. The terminal emulator allows you to communicate interactively with a remote computer over a serial cable or phone line. For some Kermits, the emulation is very simple: putting characters on the console as received and sending characters out as typed. More sophisticated versions emulate a smart terminal such as a DEC VT100, and provide keyboard macros. The file-transfer portion always has at least the standard checksummed and packetized file upload and download. Better Kermit programs add more sophisticated cyclic redundancy check (CRC) error detection, file batching and server-mode transfers. The command interpreter is usually a line-oriented command used for setting parameters and controlling the other two parts; it is accessed from the terminal emulator by a special key sequence. It can be redone as a set of pull-down menus and requesters as in MacKermit, which are readily available while in terminal-emulation mode. I'll discuss each of the parts in order below.

The Amiga Kermit terminal emulator is used to communicate with a remote computer in the same way as a terminal would be: Kermit sends out what you type and echoes what the remote computer transmits to your screen. The simplest use of this is to start up a Kermit program on the remote computer so that files can be sent back and forth. Since the Amiga console device provides ANSI X3.64 emulation (essentially DEC VT100), and Kermit uses the console device, its emulator is intelligent enough to be used with most remote computers' full-screen editors that can work with a VT100, and with any other such full-screen oriented tools. Having this capability allows you to use the Kermit program any time you need terminal-like access to another computer, not just when you want to transfer files.

Once you have established communications with the remote computer and have started up a Kermit program there, you have several options on transferring files. Chosen files can be transferred one at a time, or in groups whose names match a host-specific file name wildcard pattern. You can initiate transfers one at a time via a Send command at one end and a Receive command at the other. For example, to transfer a file named *Stuff* from the remote computer to your Amiga, starting from the point where you are using your terminal emulator and the remote host's Kermit is in command mode, you would enter the command Send Stuff to the remote Kermit's command interpreter. It will then prompt you to go into command mode at your

side, at which time you would hit the special character that puts your local Kermit into command mode, and enter the local command Receive to have it receive the file. Alternatively, you could enter Receive *Fred* to have it receive the file and change its local name to Fred at the same time. Sending files is done similarly: First type in a Receive command to the remote Kermit, then direct your local Kermit to send the file. Groups of files can be sent or received this way using the sending host's type of file name wildcard specification.

Commands always have to be entered to the remote Kermit first, as you must be in the terminal emulator to issue Kermit commands to it, and in Command mode to issue commands to your local Kermit. The Kermit on each end will wait for the other to get ready to transfer (with a settable timeout limit for quitting in case glitches happen). Based on parameter settings you provide, the two Kermit programs will negotiate the safest way to transfer data given the restrictions of their respective hosts: seven- or eight-bits of data, checksums or CRCs for error detection, the most reasonable packet size (the number of bytes of data to send in each chunk), whether the files are text or binary, and other restrictions. Once the negotiation is finished, the file transfers begin, and Kermit will keep you up to date on how much has been sent or received and whether errors have occurred. Errors don't cause it to lose data; the receiver merely asks the sender to keep resending the data packet until it comes through intact.

During a transfer you can wait for the operation to complete, or interrupt either the transfer of a single file or a whole batch. This is handy if you make a mistake, or if too many errors are causing slow transferral over a phone line for which you are being charged by the minute. Completion or interruption of the transfer pops you back into command mode, ready to do more transfers, emulate a terminal again or use other commands.

When you want to do several transfers, you should put the remote Kermit program into server mode if the remote Kermit supports it. It will then sit and wait for a series of transfer requests. At this point, you can issue a series of Send and Get commands from your local Kermit, to direct the remote Kermit to receive a file with a given name, or to send one down to you. (Get is an active version of Receive, which requests the file and then receives it in one operation.) To get the remote server to exit server mode, enter either the command Finish or the command Bye at your local Kermit.

Finish will cause the remote Kermit to exit server mode and wait for you to issue more commands to it from your terminal-emulation mode; Bye will cause it to exit and log you off the remote system (if the remote operating system allows a program to log you out—some don't). Kermit also has a capture-file mechanism useful for receiving files from a computer without a Kermit of its own. The Log command will save in a file every character received between the time you enter Log and the time you give the command Close. As this will include whatever command you use on the remote system to send the text, you'll need to edit the log file when you're done. But it works. ►

Kermit does a few behind-the-scenes manipulations for you during file transfer. When receiving a file from a system where file-naming conventions are different, Kermit will modify the received file's name to fit local restrictions. It will also attempt to keep from overwriting an existing local file when it does this. When the received file is a text file, Kermit will modify the end-of-line sequence on each line to fit local style (on the Amiga, this means ended with newline characters). It is

!	Go to CLI or run a program
Bye	Tell a remote server Kermit to log you off
Close	Turn off the Log file and close it
Connect	Enter terminal-emulation mode
Directory	Get a local directory listing
Exit	Exit Kermit
Finish	Take remote Kermit out of server mode
Get	Request a file or batch of files from a server Kermit
Help	Get a list of Kermit commands
Log	Open a log file and turn on logging
Quit	Exit Kermit; same as Exit
Receive	Receive a file a remote Kermit is sending
Remote	Issue a remote command to a server Kermit. Similar to local commands. Subcommands include Directory, Delete, Space, Help and Run (to run a program)
Send	Send a file to a remote Kermit
Server	Enter server mode
Set	Set a parameter (see Table 2)
Show	Show the settings of the parameters
Space	Show space left on disk
Statistics	Show various communications statistics
Take	Read Kermit commands from a file and execute them

Table 1. Amiga Kermit commands.

Block-check	Type of error detection
Delay	How long to wait before sending first packet (time to set receiver up)
Duplex	Set full or half duplex for emulator
Escape-char	Character used to get back to command mode from emulator mode
File	Set various file parameters, such as Text versus Binary
Flow-control	Type of start-stop communications flow control for full-duplex lines; i.e., XON/XOFF
Handshake	Communications turn-around character for half-duplex lines
Packet-length	Size of each data packet
Pad-character	Padding character for short packets if padding is used
Padding	Pad-out-the-packet flag
Parity	Even/odd/none parity
Prompt	Change the Kermit prompt
Speed	Baud rate

Table 2. Settable parameters.

thus important to tell Kermit when a file is a binary file so it will not attempt to do this.

Many Kermits, including Amiga Kermit, include a "host" of other commands besides file-transfer functions. Some are designed to set parameters for the other two modes, some are for operations on your local computer, and some are useful for executing commands on a remote computer running Kermit in server mode. The Kermit command interpreter has built-in help functions that will list all available commands, and for each command the parameters it requires, so I won't go into exhaustive detail here. A list for Amiga Kermit is included in Tables 1 and 2.

In my next column, I'll be describing some public domain programs that produce beautiful Amiga graphics based on ideas set forth by Benoit Mandelbrot: Fractal geometry and the Mandelbrot set. One of the programs produces a fractal landscape; the other displays the Mandelbrot complex number set in full color. Both are courtesy of some fine folks on USENET. See you then.■

Address all author correspondence to David T. McClellan, 104 Chevron Circle, Cary, NC 27511.

Sources:

DaCruz, Frank and Bill Catchings, "Kermit: A File-Transfer Protocol for Universities" (a two-part article), *Byte*, vol. 9, nos. 6 and 7, June and July 1984.

Da Cruz, Frank, *The Kermit File Transfer Protocol* (to be published this year by Digital Press).

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Worksheet Magic

Nothing is left out of the workings of the worksheet. Ranges of cells can be named for convenience; column widths are variable; the screen can be split into two windows; titles can be frozen; contents of cells may be copied or moved; the worksheet may be altered as a whole or only partially; the list goes on and on. Perhaps most important, Professional can use and save Lotus 1-2-3 files for transfer between computers.

The worksheet includes over 45 special functions to simplify commonly used formulas, including powerful financial functions for the internal rate of return, present value, and future value. Of course Professional also has all mathematical, trigonometric, table, conditional and logical functions.

Database Power

The built-in database can handle up to 8192 records, with a possibility of up to 256 fields. The records can be searched, sorted and analyzed to find your best salesperson or your rarest stamp. Sorts can be done using multiple criteria, in ascending and descending order. And database functions can be used to do up to seven different kinds of statistical analyses of your database.

Graphs

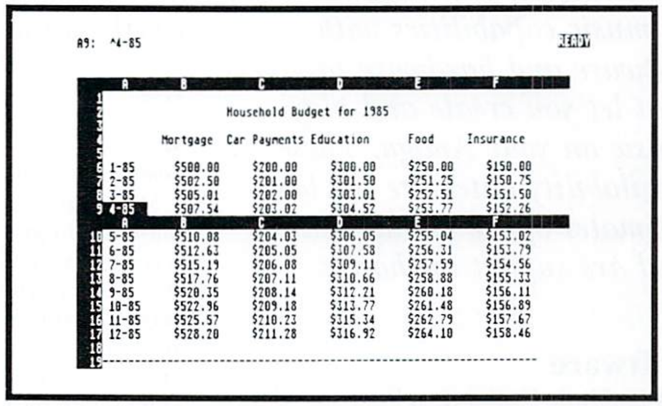
The graphing capabilities of Professional are astounding. Not only are there six completely different types of graphs available, there are tens of ways to manipulate the data, titles, grids, colors, legends, keys, and scaling of the size of the graph.

Macros

Professional also includes sophisticated macro programming commands. With several special macro commands, the user can actually *program* Professional to be dedicated to a specific task such as accounting.

Just Minutes to Learn

Professional is as easy to use as it is powerful. It comes with a user-sensitive tutorial for the newcomer. And help is built right into the program. With the handy tutorial, you will be able to create professional worksheets in just minutes.

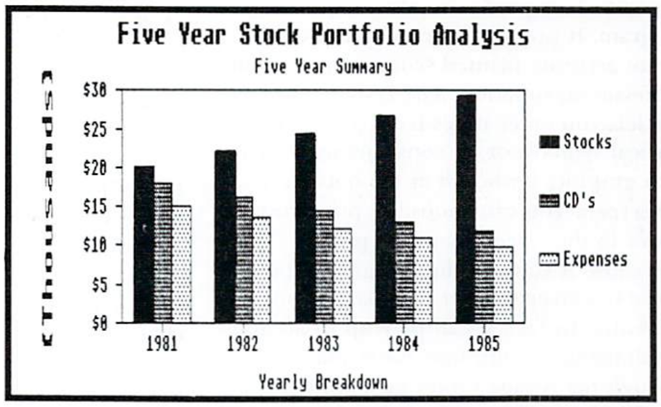


A9: ^4-85 READY

Household Budget for 1985

	Mortgage	Car Payments	Education	Food	Insurance
1-85	$500.00	$200.00	$300.00	$250.00	$150.00
2-85	$502.50	$201.00	$301.50	$251.25	$150.75
3-85	$505.01	$202.00	$303.01	$252.51	$151.50
4-85	$507.54	$203.02	$304.52	$253.77	$152.26
5-85	$510.08	$204.03	$306.05	$255.04	$153.02
6-85	$512.63	$205.05	$307.58	$256.31	$153.79
7-85	$515.19	$206.08	$309.11	$257.59	$154.56
8-85	$517.76	$207.11	$310.66	$258.88	$155.33
9-85	$520.35	$208.14	$312.21	$260.18	$156.11
10-85	$522.96	$209.18	$313.77	$261.48	$156.89
11-85	$525.57	$210.23	$315.34	$262.79	$157.67
12-85	$528.20	$211.28	$316.92	$264.10	$158.46

Integrated Spreadsheet Power



Easy-to-Use Graphs

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Send your check or money order to the address below, together with $3 for shipping and handling. California residents add 6% sales tax. COD's and purchase orders WILL NOT be accepted. Personal checks will be held for three weeks to clear. All prices are subject to change without notice.

VIP TECHNOLOGIES

132 Aero Camino
Santa Barbara
California 93117

(805) 968-9567

SYSTEM REQUIREMENTS: Amiga with 512K; One disk drive; Monochrome or color monitor; Works with printers supported by the Workbench.

Music Products for the Amiga

Many companies are taking advantage of the Amiga's built-in music capabilities with software and hardware products that let you create and play music on your Amiga. These availability dates are the best estimates of the manufacturers and are subject to change.

Software

Deluxe Music Contruction Set
Electronic Arts (price not available)

Deluxe Music Construction Set is designed to be a professional music-scoring program. It provides the tools needed to create accurate printed scores usable in any professional situation. The DMCS music editor lets you enter notes from a palette of musical symbols or by constructing chords on a graphics keyboard at the bottom of the screen. You can choose to print your scores to the screen or to the printer.

Because it runs on the Amiga, Deluxe Music Construction Set can play the scores you enter. In fact, it can play up to 36 notes simultaneously, with four notes played through the Amiga's internal sound system and 32 played through a properly equipped MIDI system. Deluxe Music Construction Set may even allow you to enter notes into the editor with a MIDI-compatible device, but this feature hadn't been finalized at press time. Available Summer 1986.

Instant Music
Electronic Arts (price not available)

Instant Music lets you jam with your Amiga. It plays three parts of a four-part score, letting you play the fourth part with your mouse. You can improvise to your heart's desire, and even if you're not a trained musician, you'll always be in key and at the right tempo—Instant Music is very forgiving.

Instant Music can play each part with the same or different instrumental timbres, including guitar, bass, drums, sax, flute and violin. You can also create your own scores with the program. Instant Music doesn't use standard musical notation, but you can save scores from the program and print them with Deluxe Music Construction Set, also from Electronic Arts. Available Summer 1986.

Musicraft
Commodore ($99.95)

Musicraft is a simple composition and playback program. It features a note editor, a synthesizer and a keyboard. The note editor lets you write, store and play back musical compositions. The keyboard feature lets you use your Amiga keyboard as a musical keyboard. The synthesizer lets you control and modify the sounds produced by the keyboard and the editor. Musicraft doesn't provide a sequencer for MIDI devices. Available Summer 1986.

The Music Studio
Activision ($59.95)

The Music Studio is a music composition and control program. It gives you great flexibility in composing and editing your musical creations, in addition to letting you play them with your Amiga or an external synthesizer under MIDI control. In fact, Music Studio can control up to 15 separate channels at the same time. Music Studio also lets you print out scores and add up to three verses of lyrics to your compositions.

With Music Studio you can create sound effects and new instruments and modify the built-in ones. The program comes with a number of compositions on disk that you can play and modify. Finally, the program comes with a "paintbox"—a tool that lets you hear what you're composing while you're composing it. Compositions created with the paintbox can be transferred to the music editor for display and printing in standard musical notation. Available May 1986.

Pitchrider
IVL Technologies ($249)

One of the advantages of computers in education is that computers appear to be possessed with infinite patience. With Pitchrider, that patience is brought to the field of music instruction.

Pitchrider synthesizes notes played by a student (and input through a microphone that comes with the software or via MIDI) and displays the score on the Amiga's screen. Students can see when they are playing the correct note and when they are making a mistake. Pitchrider is an endlessly patient music tutor. Available Summer 1986.

QRS Music Rolls
Micro W ($19.95 each)

QRS Music Rolls contain six digitized songs per disk. The material ranges from Gershwin to Madonna. Each disk contains software to play the songs on MIDI devices. Micro W is planning to introduce software to play the songs with the Amiga's native sound hardware later in the year. Available May 1986 (dependent upon the availability of Commodore's MIDI interface).

SoundScape
Mimetics ($149)

Unlike Deluxe Music Construction Set, Music Studio and Musicraft, SoundScape is not a note editor. It is the basic module of Mimetics' professional, MIDI-oriented music system for the Amiga. SoundScape features Mimetics' music operating system and includes a powerful sequençer and MIDI-event editor. Soundscape can sequence as many MIDI-controlled tracks as you can fit into your Amiga's memory, and it has the capability of massaging the MIDI information so you can get exactly the results you want.

SoundScape is an open, expandable system. It can input compositions from any of the Amiga note editors that use IFF files. Future modules will cover ear training and music theory. Mimetics is also planning to produce a tool box for the SoundScape system to allow developers and users to create their own SoundScape modules. Available May 1986.

Hardware

FutureSound
Applied Visions ($195)

The FutureSound digital sound recorder connects to the Amiga parallel port but supplies a connector for your printer. You can sample at rates up to 28,000 8-bit samples per second. The software also supports variable playback speeds and allows you to play back up to four previously recorded samples at once. The system includes a microphone, microphone jack and connecting cables. Available Spring 1986.

MIDI Interface
Mimetics; Micro W ($50)

The Amiga-MIDI interface is being produced by Commodore and sold through third-party hardware and software vendors. The companies will either sell the interface separately or bundle it with their own products. At press time, Mimetics and Micro W were planning to market the Amiga-MIDI interface. Available May 1986.

Mimetics Sampler
Mimetics ($100)

This sampler allows you to take stereo input from any audio device (including compact-disc players) and record it with great fidelity. Although designed to fit easily into a SoundScape-based music system, the Mimetics Sampler can be used as an independent device. It comes with its own recording and playback software. Available May 1986.

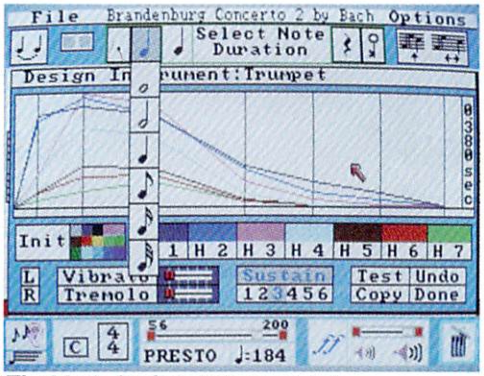
Sound Digitizer
Hippopotamus Software ($199.95)

A complete hardware and software package with everything you need to sample, modify and play back analog sounds. Features adjustable sample and playback rates and a real-time graphic oscilloscope. Available Summer 1986.

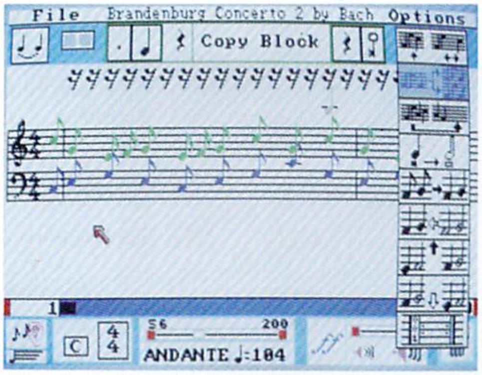
Stereo Sound Digitizer
The Micro Forge ($344.95)

With both line-level and speaker-level inputs, this stereo digitizer is a versatile piece of equipment. The software allows you to record at rates from 8,000 to 18,000 samples per second. Playback rates can be varied to produce unique sounds. You can also edit samples and save them to disk. If you have to conserve memory, you can also sample in mono.

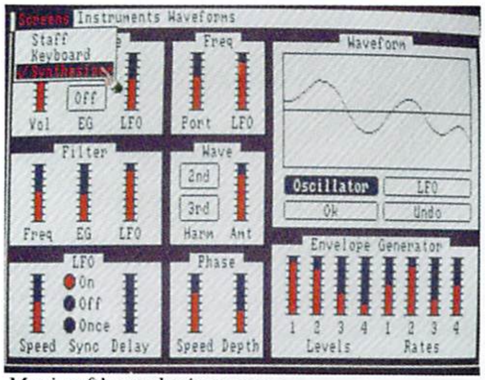
To interface the hardware, you need either the Single Slot Adapter or the Seven Slot Expansion Box, both available from The Micro Forge. The Stereo Digitizer includes the source code of the playback software and a programmer's model of the recording software. Available in April 1986.



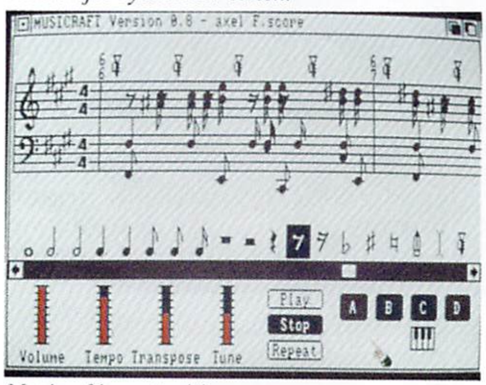
The Music Studio's instrument-design screen.



The Music Studio's composition screen.



Musicraft's synthesizer screen.



Musicraft's composition screen.

Manufacturers

Activision
2350 Bayshore Frontage Road
Mountain View, CA 94043
415/960-0410

Applied Visions
15 Oak Ridge Road
Medford, MA 02155
617/488-3602

Commodore Business Machines Inc.
1200 Wilson Drive
West Chester, PA 19380
215/431-9100

Electronic Arts
PO Box 7530
San Mateo, CA 94403
800/245-4525 (in CA, 800/562-1112)

Hippopotamus Software
985 University Avenue, Suite #12
Los Gatos, CA 95030
408/395-3190

IVL Technologies Ltd.
#3-3318 Oak Street
Victoria, BC V8X1R2
604/383-4320

The Micro Forge
4771 Cool Springs Road
Winston, GA 30187
404/949-5698

Micro W
1342B Route 23
Butler, NJ 07405
201/838-5606

Mimetics Inc.
PO Box 60238, Station A
Palo Alto, CA 94306
408/741-0117

Note: In February, *AmigaWorld* learned that Cherry Lane Technologies had been shut down by its parent company. The fate of the Cherry Lane music products for the Amiga—**Concertcraft** (aka **Harmony**), **Texture** and **Scorewriter**—was unknown as we went to press.■

Digital Canvas

Digital Canvas's current exhibit features the work of Greg Johnson and Avril Harrison, graphic artist collaborators currently doing work for Electronic Arts. All the pictures were created with Deluxe Paint in low resolution.



"Lightning" by Greg Johnson

Avril Harrison, a native of Cumbernaud, Scotland, received her formal art training at the Glasgow School of Art. After coming to America a little over one year ago, she got a job at Island Graphics, having been introduced to computer graphics by Greg. Avril, though formerly "anti-computers," apparently, judging by the quality of this work, has been won over by the Amiga.

Greg Johnson, a self-taught artist, has a degree in Bio-Linguistics. Greg became involved with computer graphics first at Island Graphics and then at Binary Systems where he worked for a few years on a space-exploration game called Starflight. (Starflight should be released for the Amiga by Electronic Arts in late '86 or early '87.) Team effort has resulted in Greg learning a lot about art from Avril, and Avril learning a lot about computers and paint programs from Greg. Since the brush (or in this case, the mouse) is only as powerful as the hand that holds it, Greg says, ". . .I think I got the better end of the deal!" ■

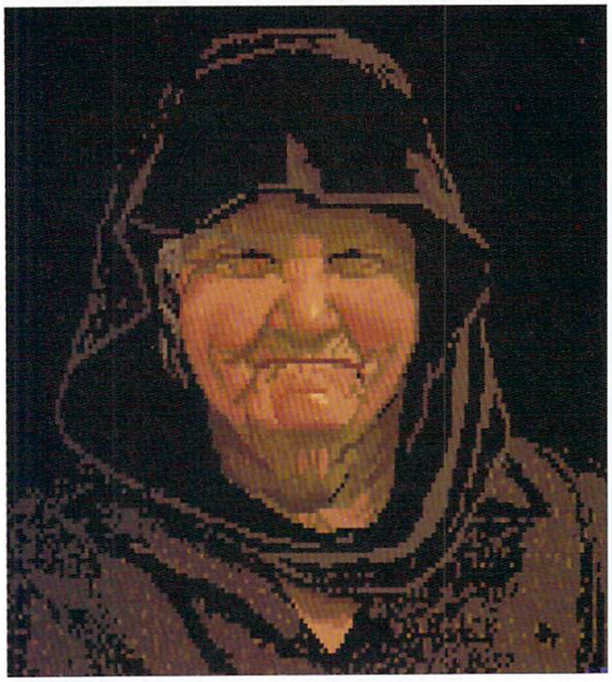
Special Note: Anyone submitting artwork to be considered for exibit in Digital Canvas should send the artwork on a disk and properly packaged to:

AmigaWorld
80 Pine St.
Peterborough, NH 03458
Attn: Art Director

Please include brief biographical information, relevant details about access to the pictures and any information regarding special products or procedures used in creating the artwork. *Please do not submit disks with less than eight finished pictures.*



"Cottage" by Avril Harrison



"Hag" by Avril Harrison



"Castle" by Greg Johnson

"Waif" by Avril Harrison





"Gorilla" by Greg Johnson



"Sea" by Avril Harrison



"Saturn" by Greg Johnson

"Atlantis" by Greg Johnson



What's New?

Compiled by Bob Ryan

Getting Down to Business

MaxiSoft has announced the release of **MaxiPlan** for the Amiga. MaxiPlan is a powerful spreadsheet program designed to take advantage of the special features of the Amiga. MaxiPlan features a huge spreadsheet (512 × 16,384 cells) that incorporates database and graphics a la Lotus 1-2-3. The MaxiPlan spreadsheet is unique. You can create four- or eight-color spreadsheets, using colors to highlight cells or ranges of cells. Each cell can have a cell note—a remark about the contents of a cell that can be displayed on the screen or passed through the Amiga's speech synthesizer. You can even have the spreadsheet echo the contents of each cell as you enter data: MaxiPlan is a talking spreadsheet.

You can create bar, line, pie and area charts with MaxiPlan's charting module. The charts are linked dynamically with the spreadsheet—change the spreadsheet and you change the chart. The spreadsheet allows you to have four sizable windows open at one time. MaxiPlan is designed to access all the memory in your machine. Its sparse memory allocation stretches the available memory by assigning memory only to those cells that are in use.

MaxiSoft has also re-released MaxiComm and MaxiDesk, making both of them completely compatible with AmigaDOS 1.1. MaxiSoft has also introduced an interesting copy-deterence scheme. For an extra $10, MaxiSoft will make you a personalized copy of one of its programs. The copy will be unprotected, so you can back it up or move it to a hard disk, but the copy will contain your Master Card or Visa number, to deter you from distributing copies of the program to others. Information on unprotected copies is available in all MaxiSoft packages.

MaxiPlan, MaxiComm and MaxiDesk list for $149.95, $50 and $70 respectively. They are distributed by Electronic Arts. For more information, contact MaxiSoft at 2817 Sloat Road, Pebble Beach, CA 93953. 408/625-4104.

If you need a complete accounting system for your small business, check out **Financial Plus**, a software package recently announced by Byte by Byte Corporation. Financial Plus includes the following modules: general ledger, accounts payable, accounts receivable and payroll. It even includes a word processor. Each of the accounting modules is linked, and you can elect to use as many or as few of the modules as you need.

Financial Plus was developed by Equal Plus, Inc. It retails for $295. For more information, contact Byte by Byte Corp., 3736 Bee Cave Road, Suite 3, Austin, TX 78746. 512/328-BYTE.

Son of Financial Plus

Byte by Byte Corp. has also released a word processor for the Amiga called **The Write Hand** ($50). It is the word processor module of the Financial Plus package. The Write Hand is a general-purpose word processor along the lines of PFS:Write. Contact Byte by Byte Corp (see address above) for more information.

Office Supplies

Brown Wagh Publishing has released two Amiga products from Micro-Systems Software: **Analyze!**, a spreadsheet, and **Scribble**, a powerful word processor. Analyze! ($99.95) lets you create spreadsheets containing over two million cells, has 40 built-in functions and makes use of pull-down menus and the Amiga's function keys. Scribble's numerous features include multiple windows and pull-down menus, mailmerging and spellchecking; it will hold two documents in memory simultaneously. Scribble is also $99.95.

Brown Wagh is also the publisher of Micro-Systems other Amiga products, OnLine! and BBS-PC. OnLine! is a powerful telecommunications terminal package; BBS-PC is a bulletin board system for the Amiga. For further information about Analyze!, Scribble, OnLine! and BBS-PC, contact Brown Wagh Publishing, 100 Verona Court, Los Gatos, CA 95030. 800/451-0900 (in CA, 408/395-3838).

Just Your Type

If you're tired of hunt 'n' peck, Scarborough Systems has a program for you—**MasterType** for the Amiga. MasterType is a game that teaches you touch typing. It includes finger positioning charts so you always know where your hands should be on the keyboard. The Amiga version of this best-selling program includes lessons on the numeric keypad and another on common programming terms.

MasterType for the Amiga gives you better control over the challenge of the game. It also lets you replay parts of lessons instead of having to replay entire lessons. MasterType's list price is $39.95. For more information, contact Scarborough Systems Inc., 55 S. Broadway, Tarrytown, NY 10591. 914/332-4545.

Fortran Lives!

A long time ago, in a computer far, far away. . . somebody came up with Fortran. Short for formula translator, Fortran is a language that excels in converting scientific and mathamatical formulas into instructions that a computer can understand. With its introduction over 25 years ago, Fortran became a favorite of scientists and engineers. Having survived onslaughts from APL, Pascal and C, Fortran is still a popular language for technical applications. And now, you can buy a Fortran compiler for your Amiga.

A/S Fortran 77 is a full implementation of the ANSI Fortran 77 standard. The compiler is written in assembly language and will compile most programs downloaded from mainframes without modification. The A/S Fortran 77 package features a symbolic debugger, linker, library manager and support for complex numbers. Also included are IEEE single- and double-precision floating-point mathematics, and VAX and 8X extensions. Programs can take advantage of as much memory as you can hang on the side of your Amiga.

Absoft is the producer of M/S Fortran 77 for the Macintosh, and it claims a great deal of code compatibility between the A/S and M/S versions. Absoft plans to upgrade the A/S Fortran 77 package in the near future to take advantage of third-party 68020/68881 boards. For more information, contact Absoft Corp., 4268 N. Woodward, Royal Oak, MI 48072. 313/549-7111. ►

◀ Video In, Picture Out

Digi-View is a new video digitizer for the Amiga. Produced by 21st Century Electronics, Digi-View accepts input from a black-and-white video camera and converts the image into an Amiga picture file that you can save and modify using any popular Amiga graphics program (Deluxe Paint, Aegis Images, Graphicraft, etc.). Unlike the Amiga Live! digitizer from Commodore and A-Squared Systems, Digi-View is not a real-time frame grabber. It takes from five to thirty seconds to capture an image. Digi-View sacrifices speed for image quality.



21st Century Electronics recommends an RS-170 monochrome camera with 2:1 interlace for use with Digi-View. You can digitize in color by using color filters with a monochrome camera. This method requires three passes, but it results in exceptional digitized color images. Color images are displayed in the 4,096-color, hold-and-modify mode of the Amiga. As yet, no graphics program is capable of manipulating hold-and-modify images.

Digi-View plugs into the Amiga's parallel port. Brightness, contrast, color, etc., are controlled by software supplied with the digitizer. Digi-View retails for $199.95. For more information, contact 21st Century Electronics, 701 Jackson, Suite B-3, Topeka, KS 66603. 913/234-6298.

Color by Juki

Juki has announced a new Amiga-compatible color printer. The **Juki 5510-Color** is a 180 characters-per-second, dot-matrix printer that uses a four-color ribbon to deliver color output. The Juki 5510-Color also features a 30 cps near letter-quality mode for professional-looking output. It can print in a number of type sizes and styles.

The 5510-Color is available in IBM- and Epson-compatible models. Amiga owners should get the Epson-compatible model and choose JX-80 from the Preferences menu. The 5510-Color comes standard with a Centronics-type parallel interface. It has a 9″ platen and a built-in tractor. A 3K print buffer is built-in, and it is expandable to 15K. The Juki 5510-Color uses fabric ribbons.

The Juki 5510-Color lists for $650. For more information, contact Juki Office Machine Corp., 20437 S. Western Avenue, Torrance, CA 90501. 800/325-6134 (in CA, 800/435-6315).

Pascal Jr.

TDI Modula-2 is a new language implementation for the Amiga. A product of TDI Software Inc., TDI Modula-2 is a full implementation of Modula-2—the langauge that Niklaus Wirth designed to replace Pascal.

TDI Modula-2 interfaces with Intuition, AmigaDOS and the ROM Kernel. It supports transcendental functions and real numbers and features separate compilation of modules. TDI Modula-2 is not copy protected and it comes in two versions. The regular version costs $89.95. The developer's version features link and load file disassemblers, a source file cross referencer and a version of Kermit. The developer's version costs $149.95. For more information, contact TDI Software Inc., 10410 Markison Road, Dallas, TX 75238. 214/340-4942.

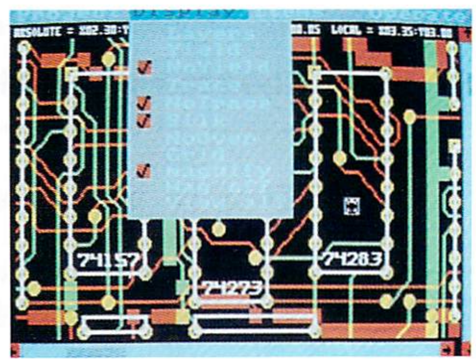
Equals Four

Olamic Systems Corp. has released its **2 + 2 Home Management System** for the Amiga. The package contains four programs—Home Financial Management, Personal Calendar, Mailing List Processor and Telephone Directory. Home Financial Management is the centerpiece of the system. It helps keep you on your budget by tracking your personal income and expenses. Personal Calendar lets you organize your appointments and gives you a record of time spent with a particular person or on a particular job. Mailing List Processor keeps your personal or small-business mailing list, while Telephone Directory records your important phone numbers.

2 + 2 Home Management System retails for $99. For more information, contact Olamic Systems Corp., 141 West Jackson Blvd., Chicago, IL 60604. 312/786-1410.

Electrical CAD

So you don't like your Amiga? In that case, SoftCircuits Inc. of North Lauderdale, FL, has a product that can help you design a replacement for your Amiga. **PCLO** (*P*rinted *C*ircuit board *L*ay*O*ut) is a powerful computer-aided design program that turns your Amiga into a sophisticated engineering tool. PCLO allows you to design and test printed circuit board layouts. It features multiple layering and full trace manipulation and editing.



PCLO is not cheap: It retails for $1,000. It is a tool designed to meet the needs of engineering professionals. Multiple site licenses are available. For more information, contact SoftCircuits, 401 SW 75th Terrace, North Lauderdale, FL 33068. 305/721-2707.

Bump in the Night

Polarware, a division of Penguin Software, has released two interactive fiction games for the Amiga—**Transylvania** and **The Crimson Crown**. Both were created using Penguin's Comprehend System, which combines graphics with a powerful parser to create graphics adventures with the depth and complexity of text-only interactive adventures. ▶

In Transylvania, you're in a battle against time to save the Princess Sabrina from a land of werewolves and vampires. In The Crimson Crown, a sequel to Transylvania, you must recover the Crimson Crown from the evil Vampyr before he can recover all of his powers. The games retail for $39.95 each. For more information, contact Polarware, PO Box 311, Geneve, IL 60134. 312/232-1984.

Not for Navels

Amiga-Lint is a utility that analyzes your C programs. Running under CLI, Amiga-Lint reports on bugs and inconsistencies within your C programs. It reports on type inconsistencies across modules, does parameter checking, lists uninitialized variables and reports on variables and code sections that are never accessed.

Amiga-Lint is available directly from Gimpel Software, 3207 Hogarth Lane, Collegeville, PA 19426. 215/584-4261. The retail price is $98.

Bright Idea

If you have trouble organizing your thoughts, you should try **Flow**, an idea processor for the Amiga computer. Flow lets you organize and arrange your ideas in outline form so you can see the relationship between different ideas. Flow is accessed via Workbench and takes full advantage of the Amiga's Intuition interface.

Flow retails for $99.95. For more information, contact New Horizons Software, PO Box 43167, Austin, TX 78745. 512/280-0319.

Fun Stuff

Electronic Arts has released two more games for the Amiga: **Arcticfox** and **Skyfox**. Arcticfox puts you at the controls of a futuristic tank doing battle in the frozen Artic wastes. Skyfox lets you take control of a jet fighter. You do combat with enemy jets and attack ground targets. Both games take full advantage of the Amiga's advanced graphics and sound capabilities. For more information, contact Electronic Arts, 1820 Gateway Drive, San Mateo, CA 94404. 800/227-6703 (800/632-7979 in CA).

Amiga Learning Software

MicroEd, an educational software company located in Eden Prairie, MN, has announced two products for the Amiga. **Punctuation Series** retails for $29.95. Designed for students in grades 4 and up, it gives students practice in identifying punctuation errors within a standardized test format. **Advanced Vocabulary Series** ($49.95) helps students develop a stronger vocabulary; it is for upper-grade level or advanced students. An Amiga Demo package is also available from MicroEd. For more information about these and other MicroEd products for the Amiga, contact MicroEd Inc., PO Box 444005, Eden Prairie, MN 55344. 612/944-8750 or 800/MICRO ED.

Twelve Water Horses

Hippopotamus Software Inc., a major developer for the Atari ST, has announced that they are developing a dozen new products for the Amiga. On the software side are: **Concept**, an outline processor; **Word**, a word processor (naturally); **Pixel**, a sprite editor; **Spell**, a spelling checker; **Fonts**, a font editor; and **Computer Almanac**, a compendium of 35,000 interesting facts you can access with an AI-based parser.

Hardware products planned for the Amiga include a **Sound Digitizer**, a black-and-white **Video Digitizer**, **BSR Home Controller**, **Eprom burner**, **WAO Robot** and **Hippo Clean** (a disk cleaning kit). Computer almanac is available now; other product release dates hadn't been determined at press time, but the majority of these products were expected to be completed this summer. We will include details of Hippopotamus products as they become available. For more information, contact Hippopotamus Software Inc., 985 University Avenue, Suite #12, Los Gatos, CA 95030. 408/395-3190.

Newsbriefs

Eartype is a word processor for the vision-impaired that takes advantage of the speech-synthesis capabilities of the Amiga. For $5.50 (the cost of materials), anyone can obtain the program and complete documentation including a quick instruction sheet. People with impaired vision can also obtain the documentation on cassette tape for another $1.50. For more information, contact Richard Ramella, 1493 Mt. View Ave., Chico, CA 95926.

For $795, you can buy a **Commodity Futures Real-time Tic Chart** package that, in conjunction with the Market Monitor satellite decoder from Bonneville Telecommunications, allows you to monitor tic by tic quote information from the commodity exchanges. For more information, contact Ensign Software, 7337 Northview, Boise, ID 83704. 208/378-8086.

Reviews

Rags to Riches

A good flexible accounting package, but not for the accounting uninitiated.

By N. Roberts and Ann M. Lopes

Choosing an accounting package to automate your recordkeeping is not an easy task. Accounting packages come in all shapes and sizes. Some accounting packages are glorified checking account registers that allow you to keep track of all deposits and checks drawn on your account. Other packages contain several different components to assist you in maintaining detailed accounts of certain aspects of your business.

Rags to Riches is Chang Labs Inc.'s series of accounting software packages for the Amiga, designed to help solve the accounting problems of small businesses. It consists of three modules: Amiga Ledger, Amiga Receivables and Amiga Payables. Each module is menu driven and can be used independently or in conjunction with the other modules to form an integrated accounting package. We will first consider the important features and requirements of an accounting package, then we will look at Rags to Riches and see how well it fits the bill.

In General

If you sell goods on credit, as the number of customers who owe you money increases, you will want to keep track of *who* owes you and how much. An accounts receivable package will do this for you. If you buy a lot of merchandise from several different sources, an accounts payable package will help you keep track of who *you* owe and how much. A general ledger package contains all your accounting records. It keeps track of the revenues, expenses, assets, liabilities and net worth of your business.

A good accounting package should help you keep track of your finances by showing where your money is coming from and where it is going. It should provide a balance sheet that shows assets, liabilities, net worth and an income or profit-and-loss statement.

When choosing your accounting package, there are several factors to consider. For instance, are you comfortable with the double-entry bookkeeping system or are you more comfortable with the "one-write" method? Do you keep your books on a cash basis or an accrual basis of accounting? Do you have more than one company? Have you used a computer before, or is this the first time?

The most important feature of any accounting package is *flexibility*. It is important to be able to modify software to fit your needs. Your software should be able to expand with your business. If not, as your company grows, your software will become obsolete. One caution: Many accounting software packages come with several different modules, and it is important to ensure that you don't have to continuously add new information for each module. Ideally, all the modules should use the same information, keeping data-entry time to a minimum.



In Particular

To use Rags to Riches with the Amiga, you should have a printer. An additional disk drive, though not required, would make using the product much easier; a 256K memory expansion would provide more information storage space for your records and is therefore also very desirable. Before running the program, you should be very familiar with disk-handling procedures for the Amiga. You will need two formatted disks: one to make a working copy of the program and the other to store your data.

Knowledge of financial record keeping or bookkeeping is crucial to the successful use of this package. The Rags to Riches user manuals do not include a comprehensive coverage of accounting theory, a fact that is clearly stated in the manual. Users should be familiar with such basic accounting concepts and terms as double-entry bookkeeping, chart of accounts, closing cycles, posting to an account and cash versus accrual basis of accounting. If you are unfamiliar with these accounting concepts, you should consult an accountant or a good primer on accounting principles prior to attempting to use these packages.

Since Rags to Riches is an integrated accounting package, once you enter data into one module, you can pass the data onto any of the other modules. For example, suppose you buy the Accounts Payable module. After entering the list of vendors to whom you owe money, you would like to have this information passed on to the General Ledger. All you have to do is post the information to the ledger. The data automatically passes from the Accounts Payable module to the General Ledger module—you do not have to reenter the information.

The Amiga Ledger package is not an easy package to learn if you are not familiar with the subject. However, Chang Labs has incorporated several features that are aimed at making the learning process easier. These features include online help, sets of books complete with their own chart of accounts and sample transactions.

Anyone who uses a spreadsheet program and is familiar with menu-driven programs knows that menus can be slow and frustrating. In Rags to Riches, online help is provided in the form of two help modes: a learn mode and an expert mode. The learn mode, complete with help screens, provides a detailed explanation of the screen commands. The expert mode omits the online descriptions and allows the experienced user to move quickly through the menus without the usual prompts. This feature is

very flexible and affords the user the ability to switch back and forth between the two different modes with the touch of a function key. You can work in the learn mode until you become more familiar with the program, then easily switch to the expert mode.

The master disk includes a group of templates or sample books for a variety of different industries including the service and retail industries. One of these templates can be used as a starting point for setting up your company's books. A list of transactions typical of many businesses is provided in the appendix. These include mortgage payments, payments made by check and payments received on an invoice, among others. These sample journal entries can answer questions that may arise when using the package, such as "How do I record the payment of my loan, since part of the payment goes towards paying back the principal and part goes toward paying interest?" or "I am on the accrual basis of accounting, how do I record the prepayment of my rent expense?" For each entry listed, this section explains the accounts affected and the order in which the accounts should be entered into the system. This section can be of great help as you continue to work with the package.

Other important features help to make the software easy to use. For instance, Rags to Riches provides an audit report that lists all transactions entered and posted to the system. By examining this report, you can quickly spot and correct any data entry mistakes. A built-in error-checking system will draw your attention to some errors at the time of entry. For example, let's suppose you are entering a transaction to record the receipt of $2,345.89 in cash sales. To do this, you would normally debit Cash (to show an increase in cash) and credit Sales. Suppose you typed in –$2,345.89. The system would beep to indicate that you have tried to increase cash by entering a negative cash amount.

Rags to Riches allows the user to maintain an almost unlimited number of accounts. This is important if you plan to expand your business. All you need to do is set up a separate set of books for that department or business. When it comes time to do your monthly reports, you can combine the books and produce consolidated financial statements. A word of caution, though: When you do set up more than one set of books, be careful how you set up the chart of accounts. This package is driven by the name of the account or the key variable that you can use as an identification of an account. If you use the same key variable for different accounts, you may get something different from what you had intended. If you take care in assigning key variables to your accounts, and if you cross-reference these variables from one set of books to another, you should experience no trouble.

A toll-free number is included in the package. You can call if you have any problems with the package—whether setting up your books, entering entries or with defective software.

In Question

Despite all of these good features, Rags to Riches is not for everyone. If you plan to automate your books and if you do not have an accounting background, you will probably find that you need the help of an accountant to set up your books. (This is not necessarily a reflection of the Rags to Riches series, but a relection of the complexity of a double-entry accounting system.) However, with a little practice, you will find that a double-entry system is really quite logical.

Though you may find the fact that you cannot design your own reports a limiting factor, you should note this before purchasing any accounting package. The reports available within the package are standard reports. It is not possible for you to enter the report and change headings or to add new columns. Keep this in mind when you are looking for a package.

Though the user's manual is clear and easy to follow, it could be more comprehensive. A tutorial chapter walks you through a few of the commands. However, it does not show you how to set up or close your books, or how to consolidate the books of several companies. In fact, at the end of the tutorial chapter, you are invited to read the rest of the manual to become more familiar with the features of the program. An interactive tutorial, complete with a chart of accounts for a small company and a list of four or five transactions for the month would make the software easier to use. If the tutorial walked the user through the process of setting up the books, entering the monthly transactions, making corrections and printing a monthly report, it would help the user gain confidence in using the system. Then the user might be more receptive to exploring other features of the system on his or her own.

In Conclusion

For the experienced user—one who knows accounting and is interested in automating his books—Rags to Riches is a flexible accounting package at an affordable price. However, for those without an accounting background, *unless* you work closely with an accountant, Rags to Riches is probably not for you.■

Rags to Riches
Chang Labs Inc.
5300 Stevens Creek Blvd.
San Jose, CA 95129
408/246-8020
Three modules, $500; $200 separately
Requires a printer (external drive and 256K memory expansion optional, but recommended)

Special Note:*The version of Rags to Riches reviewed here did not take full advantage of the Intuition operating system (mouse, windows, pull-down menus, etc.). Right at press time* AmigaWorld *was informed by Chang Labs that Rags to Riches, as of June or July, would fully support Workbench. Apparently, Rags to Riches will feature mouse use, more graphics displays of accounting information and will have a threefold increase in its reports. It will also be a multitasking product: You will be able to run the different modules of the package in separate windows simultaneously. Contact Chang Labs for more details.*

Also, to anyone who has experienced problems printing out from Rags to Riches, Chang Labs has released this statement: "The Amiga Rags to Riches product you have may contain system files that were distributed during the Amiga development phase. We have confirmed with Commodore-Amiga that a new printer driver is available. If you experience any printing problems, please contact the Chang Labs support group at 1-800/972-8800 (California residents, 1-800/831-8080) for instructions on how to update your printer driver." ►

Time & Task Planner

Getting there may not be half as fun, if you're too late.

Time & Task Planner is a simple program for scheduling and keeping track of appointments, meetings or other responsibilities. It can be used by up to five different people for keeping schedules (each with their own password protection, if desired). The program is divided into four sections: an appointment scheduler, a "to do" list, a future-planning list and "5 days at a glance." Two other programs are included: a transfer program that allows you to copy entries from either the "to do" or future planning lists to the appointment scheduler and a calendar program that can generate calendars for any selected month or year between 1910 and 2399.

Arriving on Schedule

The appointment scheduler lets you enter up to 18 appointments per day for 60 days. All of the features are menu driven, requiring few keystrokes. No mouse or Workbench-like options are incorporated (like pull-down menus or windows), but the program is easy to use, so they are not missed. The appointment scheduler has all the features that you would expect, such as insert, delete, print, view a new date (either by entering the entire date or an offset), block inserts, etc., plus a handy feature that lets you display a small calendar of the month



at any time. Time & Task Planner also lets you define your own daily templates (for example, if you need appointments scheduled every 15 minutes rather than the default of every 30 minutes). It also has a "find" feature that will search the entire scheduler for specific entries.

The "to do" list section of Time & Task Planner lets you enter up to 60 items with date and rank (handy for prioritizing items). All the items can be sorted by date, rank, or alphabetically. Once sorted, the list can be copied over to the appointment scheduler or printed. The "to do" and future-planning sections let you schedule items up to 50 years in advance, and both lists flag items that have already been copied to the appointment scheduler.

The future-planning list is nearly identical to the "to do" list except that it lacks ranked entry. Instead, it calculates the number of days away an entered item will occur. Another feature of both the future-planning and "to do" lists is the ability to enter an offset rather than a discrete date, so you can enter +14 in the date field and it will calculate what the date will be in two weeks.

The "5 days at a glance" option is one of the most useful features. While the entries are truncated, they are still understandable most of the time (especially when you keep the 5 days at a glance in mind while entering appointments in the other sections). Once you have selected the starting date, 5 days are displayed on the screen, and you can then scroll up or down to view all 18 entries for each day. The printout of the 5 days at a glance screen also includes empty lines at the bottom for "to do," future and expenses additions. This makes it ideal for business trips as well as once-a-week quick reference printouts.

Time & Task Planner has very few drawbacks. It could be faster (it was written in ABasiC). I can think of a couple of things that I wish had been included: a place for phone numbers and the ability to alter some of the defaults. However, these are more in the way of my personal preferences, rather than deficiencies in the program. Time & Task Planner has one overriding quality that makes up for any minor faults—it *works*. It does exactly what a program of this type is supposed to do, and it does it very well.

Get Your Act Together

After using this program for a few days, you will get the feeling that a great deal of time and effort went into making it a practical tool; if authors wrote word processors, they might make them the way Time & Task Planner was made. It may not have thousands of bells and whistles, and it may not be the most powerful, extensive or flashy program that you will own, but if personal time management is important to you, it is a program that you will probably use every day of the week. If you don't have to keep track of appointments or plan things in advance, then Time & Task Planner won't interest you, but if you work in an office environment, attend meetings, have deadlines to meet, plan ahead, schedule projects, etc., then Time & Task Planner is worth the money.

Organizing your time efficiently and effectively may not be the only reason you have for buying an Amiga, but the practical benefit you can receive from accomplishing this using Time & Task Planner will definitely help justify the purchase.■

—*AmigaWorld*

Time & Task Planner
Gander Software Ltd.
3223 Bross Road, "The Ponds"
Hastings, MI 49058
616/945-2821
$100 ($110 if user requires ABasiC)
Requires 512K (printer optional but recommended)

CD20 Amiga Hard Disk System

The first available hard disk for the Amiga provides lots of room, but has some software problems.

The speed and storage capacity of the Amiga's 880K floppy-disk drives are adequate for most applications. Many applications, however, cry out for the speed and capacity offered by a hard disk. The Amiga Hard Disk System from The Micro Forge is the first hard disk available for the Amiga. It isn't perfect, but it does give you a lot of storage space.

The CD20 system includes a 20-megabyte disk drive, a power supply, a single-slot adapter and case and an interface card. On the software side of things, the CD20 includes utilities to configure and install your hard disk, and utilities to format, backup and restore the disk. A sixth utility program lets you park the read/write head of the drive before storing or transporting the disk drive. Documentation consists of an eight-page, stapled manual.

Set-up

Before you can use the CD20, you have to set it up. You insert the disk-controller card into the slot on the adapter and attach the ribbon cable from the disk drive to the disk-controller card. Next, you attach the single-slot adapter to the Amiga's expansion bus. Finally, you attach the power supply to the disk drive and to your wall outlet.

I set up my CD20 in about three minutes. If you're familiar with computers, you'll have no trouble setting up the hardware. By the way, the single-slot adapter doesn't con- ►

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"Comparable advertised price" does not include typographical errors on the part of other vendors, or prices that do not reflect higher shipping costs, credit card charges, or membership fees. The $1 off offer only applies to items where Northeastern's price is not already the lowest. Final judgement remains with the manager on duty.

tain an expansion bus of its own. You can't expand past it.

If you have a phobia about handling printed-circuit boards, then you shouldn't mess with the CD20. Also, the single-slot adapter case, disk drive and power supply are not a very aesthetically pleasing combination. They take up about half the desk space of your Amiga system unit. The shortness of the connectors between the power supply and the drive keeps you from hiding the power supply under your desk.

Software installation

Once you have the hardware connected, you boot your system with the supplied Workbench disk. This disk contains a drawer called Hard Disk Utilities. Inside is the program you need to have AmigaDOS recognize the presence of the CD20.

The first program you use is ConfigureDrives. Here you designate the size of your drive. Next, you use HDFormat to format the drive. Formatting takes a couple of minutes to complete, which may surprise you if you're used to formatting times of 30 minutes to an hour for other machines. The catch is that HDFormat *doesn't* verify the drive.

Once you've formatted the CD20, you get AmigaDOS to recognize its existence by running InstallDrives. Once InstallDrives is completed, you'll get an icon for the hard disk on your Workbench screen. You'll then be able to access the drive normally, using the device name DH0:. You must run InstallDrives whenever you boot your Amiga system. Once you've set up your hard disk, you can modify the startup-sequence file of the disk containing the Hard Disk Utilities to automatically run InstallDrives. The manual contains a suggested startup-sequence that also assigns the hard disk as the SYS: device. This is the next best thing to booting off of the hard disk, which is impossible with the Amiga.

Operation

Once I had my drive set-up, configured, formatted and installed, I began filling it up with directories, programs and files. The CD20 is faster than my Amiga floppies, but it isn't as fast as I had anticipated. Although it spins 12 times faster than a floppy drive, the CD20 proved to be about 2–4 times faster than floppies. The CD20 is not a Direct-Memory Access (DMA) device, as is an Amiga floppy; it can't bypass the microprocessor when reading and writing.

I also noticed that the CD20 got progressively slower as I filled up the disk. I don't think this is the fault of the drive, since the same thing happened on a pre-production model of the Tecmar hard disk that we have in the office. Rather, it seems to me that the method AmigaDOS uses to identify and locate files on a disk is inadequate when the disk holds hundreds of files. (I had over 1,200 files and directories on my CD20.) The problem was especially evident when using Textcraft. I would sometimes have to wait 15 or 20 seconds—during which time the hard disk was not even being accessed—while my Amiga figured out where to put the file I wanted saved. Short of a new version of AmigaDOS, a utility that partitions the hard disk into multiple volumes would be a big help.

The CD20 also seemed to run hotter than other hard disks I've used. When I put a thermometer on the case, I got a reading of 102 degrees Fahrenheit. This didn't appear to affect the performance of the drive, but it could affect the reliability of the electronics.

Backup Procedures

The CD20 comes with a backup utility, but I had nothing but problems with it. Actually, that's not correct: The backup utility worked fine, it's the restore utility that drove me crazy.

The backup utility copies the contents of your hard disk onto floppies. When I backed-up my CD20, I filled over 17 floppy disks. The process took about three and one-half hours. Once I'd completed the backup process, I reformatted the CD20 and proceeded to run the restore utility. Everything was going fine until I got to the fifth backup floppy. I received a read error that aborted the restore procedure. When I tried to restore the disk again, I got the same error. Finally, in desperation, I deleted the offending file from the floppy. That only resulted in a file-not-found error. As a result, I was unable to restore the contents of my hard disk. A more flexible restore utility would have let me bypass the bad file, but the utilities with the CD20 take an all-or-nothing approach.

Conclusions

I have complaints about the CD20, so I can't recommend it to a casual or novice user. If you know what you're doing, however, you can work around the limitations of the system. My problems were mostly with the software, not with the hardware.

The CD20 retails for $1,494.95. It isn't a bargain, but it is an adequate mass-storage device for your Amiga.

—*AmigaWorld*

CD20 Amiga Hard Disk System
The Micro Forge
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Unique applications, tips and stuff

You may be using your Amiga at work, you may be using it at home, or you may be using it in the back seat of your car, but in some way or other, you are going to be using your Amiga in a slightly different way than anyone else. You are going to be running across little things that will help you to do something faster or easier or more elegantly.

AmigaWorld would like to share those shortcuts, ideas, unique applications, programming tips, things to avoid, things to try, etc., with everyone, and we'll reward you for your efforts with a colorful, appetizing, official *AmigaWorld* T-shirt. (Just remember to tell us your size.)

Send it in, no matter how outrageous, clever, obvious, humorous, subtle, stupid, awesome or bizarre. We will read anything, but we won't return it, so keep a copy for yourself. In cases of duplication, T-shirts are awarded on a first come, first serve basis.

So, put on your thinking berets and rush those suggestions to:

Hors d'oeuvres
***AmigaWorld* editorial**
80 Pine St.
Peterborough, NH 03458

◀ *Review Update.* As *AmigaWorld* was going to press, I received word from Commodore-Amiga that "AmigaDOS could be responsible for slowing down the operation of a hard disk containing several hundred files." I was to receive a version of AmigaDOS that contained several "fixes" to help alleviate the problem. I didn't receive it in time to report on the fixes for this issue, but I feel I can recommend the CD20 more strongly knowing that Commodore-Amiga is aware of, and determined to fix, the problems with AmigaDOS.

Brataccas

A clever interactive animated adventure game, and the first in a new genre.

Brataccas is an interactive video sci-fi adventure game created by some avant-garde game programmers at Psygnosis Limited in Liverpool, England; Mindscape is the U.S. distributor. The disk jacket claims it is the "first in a new generation of electronic leisure products," and this seems accurate. Compared to any other micro game I have seen, Brataccas is unique.

In the game you are Kyne, a scientist and space fugitive on Brataccas, a backwater mining asteroid, in search of the information needed to clear your name of the unjust charge of "a crime against humanity." The charge was brought against you by the "government" for your refusal to reveal to them genetic discoveries you made concerning the creation of a super being, which they wanted to use for ill. And not only does the government want you, dead or alive, but the underworld has found out about your value and is after you too for their own sinister ends. You have a price on your head, and must conceal your identity as you seek the proof of your innocence.

Cosmic Comics

What makes Brataccas a novelty, however, is not the story (a routine sci-fi-type scenario), but the animated action involved. The most accurate description I can give is that it is the equivalent of an animated comic book; imagine a sci-fi comic book where characters move freely from frame to frame, in any direction, and each page contains but one scene, and you will begin to get the idea. However, this story never "reads" the same each time you assume the role of Kyne, depending on your decisions. The other approximately 60 characters move around, not under your control, regardless of whether you are moving at all. You can accompany them to other locations, run from them, ignore them or sword fight with them, at your instigation or theirs. And, adding to the electronic comic-book feel, you often will communicate with them, or yourself, via conversation bubbles (more on that later).

Each scene contains at least one entrance and one exit, but more often you have several optional paths: doors you must open or automatic doors and elevators. The game has many different screens, each presenting different possible courses of movement: up, down, backwards and forward. Along the way are objects you can pick up, all of which are valuable in the appropriate situations. The difficulty and frustration often involved in picking up objects is probably one of the game's worst flaws, but in the context of the whole, it's not enough to critically mar the game. One of the most clever



features of the game, concerning movement, is the Transporters. These are devices that you can enter and by which, with a few mouse actions, convey yourself to some other location. They are reminiscent of Dr. Who's phone booth, and may inspire you to mutter, "Beam me up Scotty!" as you jump into one to escape some Henchman, Asteroid-Belt Policeman or irate droid.

Going Somewhere?

Movement is a very important aspect of this game, and it will probably take you hours to become proficient at moving Kyne. Some people will be discouraged by the learning time involved; I feel it's worth the effort, though after considerable practice I still often run into walls. You move Kyne by mouse (or keyboard, but I wouldn't recommend it; you can't use a joystick with the Amiga—only with the Atari 520ST—which is

another complaint I have since it seems to beg for it, though I've gotten quite good at it with the mouse). You can make Kyne walk, run, jump, squat, sword fight, pick up items (or drop them), all by mouse actions. He can be turned around—he has four viewable sides, as do the other characters—and can carry all manner of objects at once.

The other figures roam the interiors and exterior of Brataccas, few of them aliens you would want to hobnob with, Brataccas being a notorious haunt of galactic social misfits. A bad place to visit, you wouldn't want to die there; but when (not if) you do, you are revived and returned gracefully to the entrance room to start again. When this happens, you will find things on Brataccas the way you left them: If you have been aggressive, chances are good you won't be met with tea and sympathy. A data disk can be used to save up to five separate games, so you can return to a scene of victory or demise.

Alien Conversation

When you meet certain characters, movement will be suspended, and a conversation by comic-strip-like bubbles will ensue. The conversations are brief and you are usually given two or three choices, which you select by a mouse button when the one you want appears. Your responses can prompt attack or get you vital information. Also, often when you decide to pick up or put down an object, a soliloquy follows in which you choose your activity. If a lot of objects are involved, this can be tedious, but your choices are usually few, so it's bearable. Some conversations are quite humorous: Once I was put in jail, and having no money with which to bribe the policeman (being on Brataccas can encourage one to vice) he remarked, "Have a nice day," as he left the cell.

Brataccas has numerous other notable special features. For example, video cameras in many rooms monitor your activity and can make public any impropriety you engage in (killing someone or -thing, specifically). The next time you see a policeman, he will probably call you a murderer and draw his sword; either run, win the duel, or it's curtains. Information spreads behind the scenes, and there are only bad rumors on Brataccas. Also, speakers and video screens are scattered throughout the rooms, and can reveal valuable information. Kyne can disable or gain control of these devices through throwing switches or by capturing control panels, though of course it's illegal.

The game does have some flaws besides the few I have already mentioned. It will slow down considerably if numerous characters are involved in any given screen at one time. However, the complexity of what's going on here (graphics alone) and the random outcome of such encounters makes this a small inconvenience in my view. (It must really bog down on those machines without graphics coprocessing.)

The colors chosen for the game are not those that I would have chosen—they are rather gaudy—but the defect is outweighed by the game's other unique features and the poster you get of the super cover painting by illustrator Roger Dean. Little sound is employed, but the intro music is very appropriate.

Sometimes the characters act in an erratic and confusing manner (graphics-wise) and seem at times to go a bit haywire. I haven't found this a problem; again, the novelty of the game makes such quirks easily forgivable. (One character I killed seemed to be perpetually falling in the elevator shaft he fell into, but the creep deserved it.) I expect these types of problems to be the challenge for programmers of future games in this genre; Brataccas is an icebreaker, and truly new ideas always have their rough edges.

The Last Scene

Once I overcame the difficulty in learning to move Kyne, I found something I really like—a clever game that allows a lot of freedom in your choices and movement; if you get weary of a conversation with some two-bit space thug, you can simply turn around and walk away. It is the most unusual game I have seen for the Amiga so far, and, for a micro game, a unique accomplishment in animated graphics. Brataccas requires 512K, but it is impressive, compared to other programs I have seen that need 512K to do much less, that it resides entirely in memory once loaded—a tribute to the programmers at Psygnosis.

I am rarely captivated by any micro game, but I would buy Brataccas and can enthusiastically recommend it. This could be a Pandora's Box—now I'm waiting for a game like this that allows keyboard input in the conversation bubbles, with voice synthesis... an animated-interactive-video-interactive-text adventure... maybe.

Well, Psygnosis? ■

—AmigaWorld

Brataccas
Mindscape Inc.
3444 Dundee Road
Northbrook, IL 60062
312/480-7667
$49.95
Requires 512K

Help Key

By Bob Ryan

Puzzling Amiga questions got you backed into the proverbial corner? Express them to us at Help Key, AmigaWorld *editorial, 80 Pine St., Peterborough, NH 03458.*

UndeSIDEd

Q: I recently purchased some commercial software that arrived on a single-sided, double-density diskette. The software works, but I'm wondering if the single-sided diskette could damage the read/write heads inside my Amiga disk drive.

Larry Groome
Indianapolis, IN

A: Single-sided disks will not harm your Amiga disk drive. In fact, the *only* difference between single-sided and double-sided disks is that single-sided disks are verified by the manufacturer on one side only, while double-sided disks are verified on both sides. Otherwise, the disks are identical.

Should you be concerned about using a disk that is only verified on one side? I don't think so. For many years, I used single-sided disks with my Apple II, while Guy Wright (*AmigaWorld* Editor-in-Chief) used the same brand on his C-64. The funny thing is that the Commodore drive records on the top surface of the disk while the Apple drive uses the bottom surface! Neither one of us had any problems, although only one of us was using the manufacturer-verified side of the disk.

Questions, Questions

Q: I heard that there is a new 68000L12 processor (12 MHz). Could I use this chip in my Amiga? Also, will you be reviewing the 68020 board from Computer System Associates?

I also have some questions about AmigaWorld. *When are you going to a monthly format? When do we get articles about AmigaDOS and Amiga Basic? When do we hear more about new products for the Amiga? Will you report the death of the Atari 520ST? How can I get a copy of your Premiere issue?*

Mark T. LeVarn
United States Military Academy
West Point, NY

A: You could pop a 12 MHz 68000 into your Amiga, but it wouldn't do you any good. The Amiga system clock regulates the speed of the processor, and that speed is fixed at 7.12 MHz. To get the Amiga to take advantage of a 12 MHz processor, you'd have to redesign the entire motherboard. Concerning the CSA board (the Turbo Amiga), we have a review of it in the works. Look for it in an upcoming issue.

AmigaWorld will go to a monthly format when the Amiga market gets big enough to justify the move. Right now, there aren't enough companies that can afford to advertise on a monthly basis, and there aren't enough Amiga owners to make up for the reduced advertising if we go monthly. It's purely an economic decision: If it were left up to the editors, we'd already be a monthly (and we'd probably be out of business).

We began publishing more technical material with our May/June issue. Look for that trend to continue. We publish new product information in the What's New? section, based upon manufacturer press releases. We try to avoid mentioning products that won't be available when the magazine appears, but we occasionally get burned when a product is delayed. We don't want to frustrate you by announcing products too soon before their release. (Remember when the Transformer was due out in October '85?) You can order back issues by calling 800/258-5473. They take VISA, MC or AE.

I don't anticipate ever having to report on the death of any of the Atari machines, nor do I want to. The Atari 520ST looks like a good machine for its price. I happen to think that the Amiga is a superior machine, but I don't subscribe to the notion that, because I have an Amiga, I'm automatically a soldier in some holy war against Atari. I hope the ST machines do well, because competition is necessary in the computer industry. It helps keep prices low and stimulates innovation and new products.

The Science Machine

Q: As a scientific researcher, I'm interested in using the Amiga in conjunction with my work. Many of the programs I use are written in Fortran. Will a Fortran language be available for the Amiga in the near future? Also, is any sort of floating-

point processor (analogous to the Intel 80287) anticipated for the Amiga?

Thomas G. Patterson
Spokane, WA

A: Check out the What's New? section for information about Absoft's Fortran 77 compiler for the Amiga. Also, the 68XXX family from Motorola does include a floating-point processor, the 68881. At this time, it is only available in conjunction with 68020 processor boards. See What's New? in our March/April issue.

Hard-Disk Quiz

Q: I'd like to buy a hard disk in the near future and I'd like to know if I can transfer the contents of Kickstart and Workbench to the hard drive. Also, will the computer boot from the hard drive? Can you tell me of any manufacturers besides Tecmar who have hard drives for the Amiga?

What is a good C compiler/linker/editor for the Amiga? Is there any way to obtain the source code for programs such as ED? Finally, I have two monitors and I'd like to know if I can have the source code displayed on one monitor and the graphics output on the other?

Detlef P. Vischer
Chicago, IL

A: When you first turn on your Amiga, you're prompted to insert the Kickstart disk into the internal drive. You can't change this sequence, so there is no point in transferring the contents of Kickstart to a hard disk. Similarly, you have to boot AmigaDOS with a Workbench disk in the internal drive. Once you've booted the DOS, however, you can designate the hard disk as the SYS: device and run your computer from the hard disk. (The SYS: device is normally the disk that you use to boot the computer.) The Micro Forge is also producing hard disks for the Amiga. See the Review section for information on one of their units.

There are two C language implementations available for the Amiga: the Lattice C Compiler and Aztec C from Manx. As far as I know, there is no way to obtain the source code for ED.

If you hook two monitors up to the Amiga, they will have the same display. There is no way to send different windows to different monitors.

Digital Dilemma

Q: I need to digitize and animate a videotaped sequence. I can't seem to get a straight answer on what I would need to accomplish this using the Amiga. Do I need a digitizer and a genlock? Is any of this stuff on the market yet?

Caryn Heilman
Jersey City, NJ

A: The Amiga Live! digitizer from Commodore gives you the capability of digitizing images from a videotape source; it is a combination hardware/software product. You don't need a genlock hardware device too, unless you want to superimpose text or images (created with a paint or animation program) on your videotape. Amiga Live! will take separate images from a videotape player or video camera and digitize them in real time. (See Matthew Leed's article, "Success Story: A-Squared Systems and the Amiga Digitizer," *AmigaWorld*, March/April 1986, for more details.)

Using Amiga Live! images for animation presents a lot of problems, however. You obviously want to save each frame (or each third or fourth frame) as it's produced by the digitizer so you can later call up the frames in a paint program for coloring. The problem is that the software that accompanies Amiga Live! doesn't automatically save images to disk. Instead, by pressing a mouse button, you freeze the current image and gain access to the Save function. While the image is being saved, your videotape machine will still be running. To digitize the next frame in the sequence, you'd have to rewind the tape and run it again, hoping that you could "eyeball" the next frame in the sequence.

Obviously, the more sophisticated videotape machine you have, the easier it will be to save a consecutive series of digitized images. Many two-head VCRs give you the option of advancing one frame at a time and then freezing on a frame. Such a machine would eliminate the need to rewind the tape for every frame, but the quality of the frozen image would not be as good as that produced by a four-head VCR. The best professional videotape decks allow you to specify exactly which frame you want to display; they are very expensive.

Saving a digitized videotape sequence is a time-consuming process. You can make it easier by employing the best videotape deck you can get your hands on. The Amiga Live! digitizer should be available by the time you read this.

Products Mentioned

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215/431-9100

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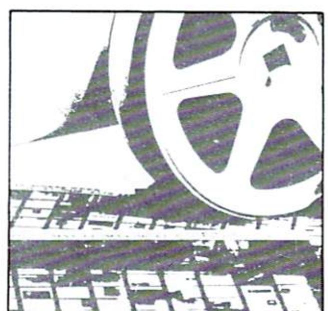
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Coming Attractions

The MS-DOS Connection—We examine products that let you run MS-DOS software on your Amiga.

Using Libraries from Amiga BASIC—Do anything a C programmer can do. Includes a mini-shell program.

Color Printers—We compare a half dozen to find the best mate for your computer.

In addition, Part II of Fundamentals of C, a new tutorial on Amiga BASIC graphics, a look at the AmigaDOS filing system in info.phile, and our usual lineup of reviews, news and things that go bump in the night.

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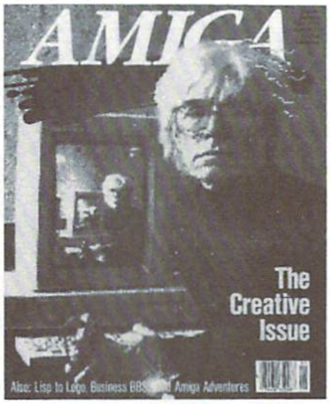
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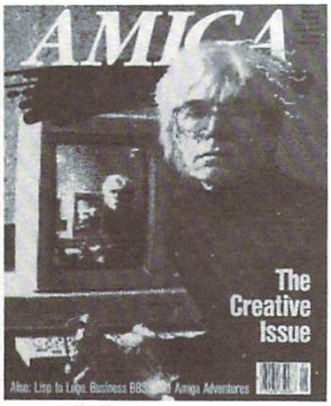
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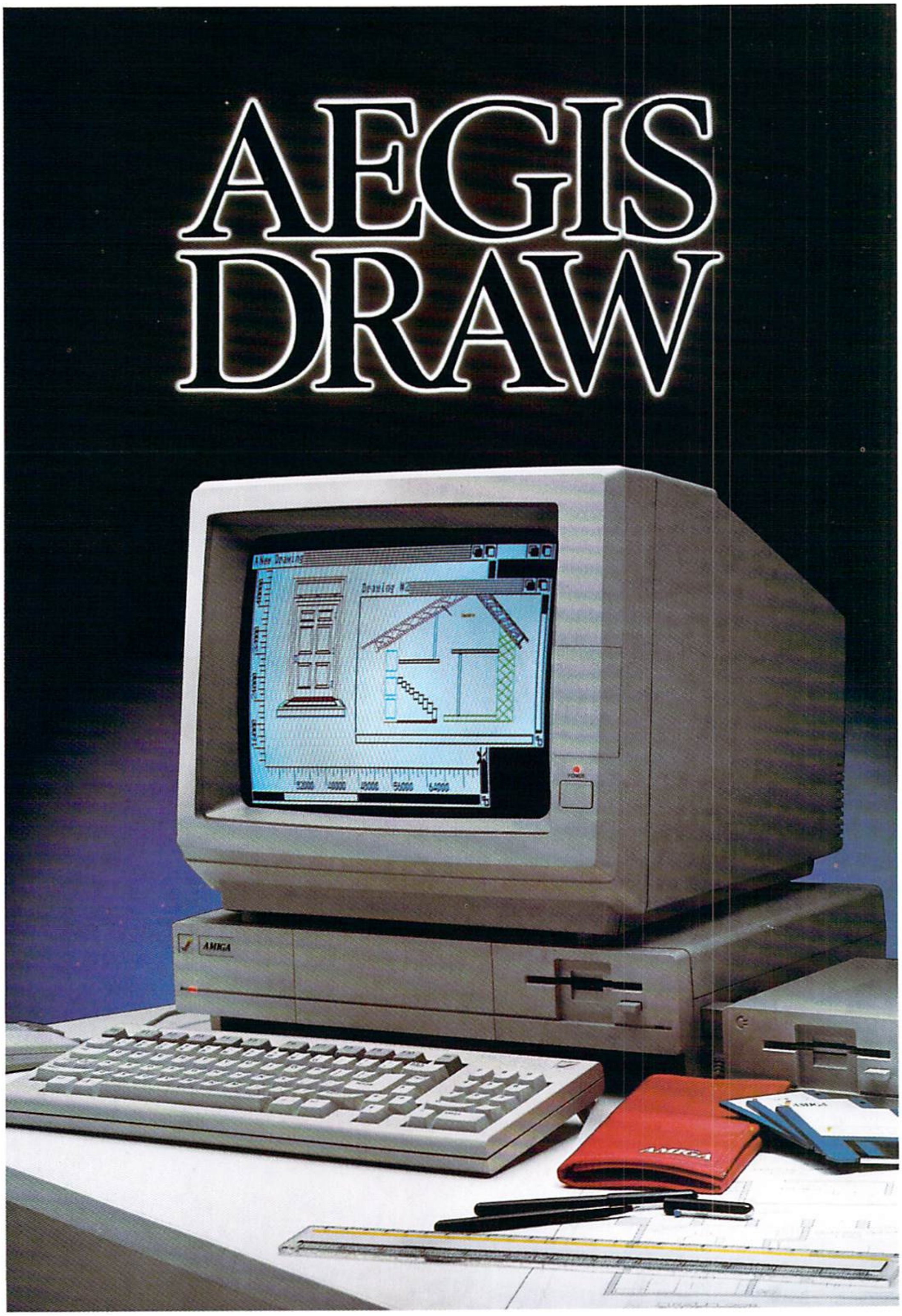
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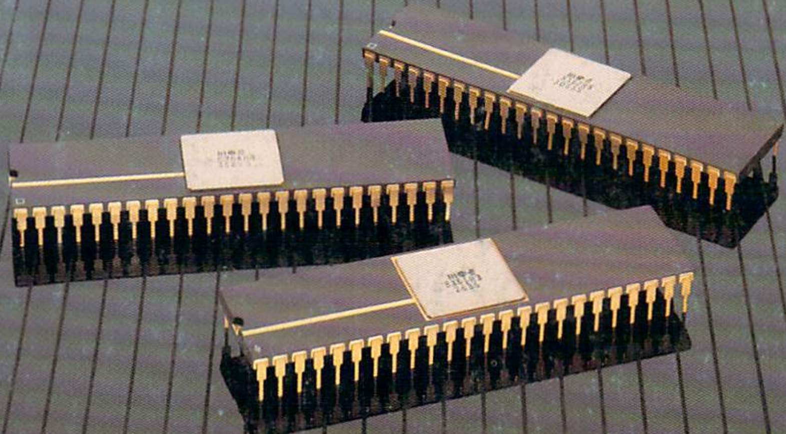
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